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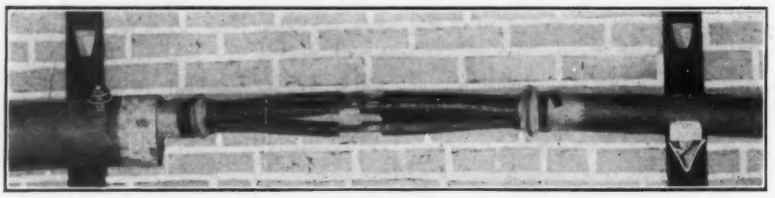

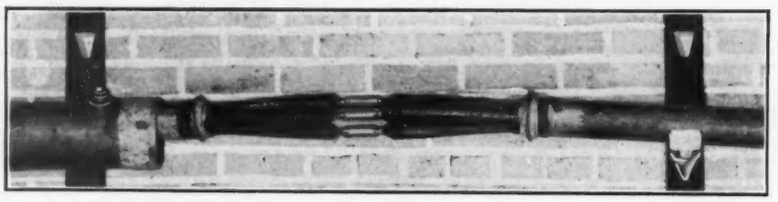

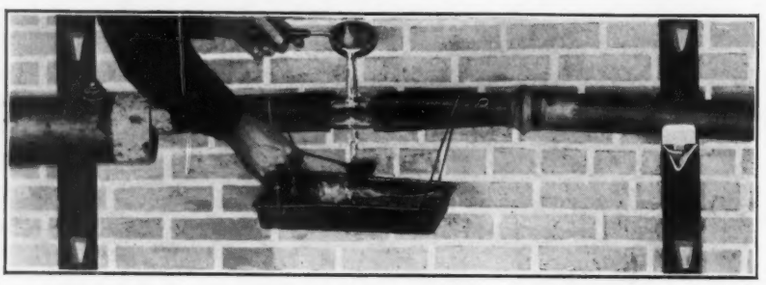

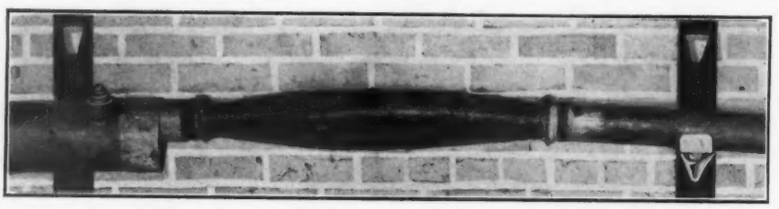

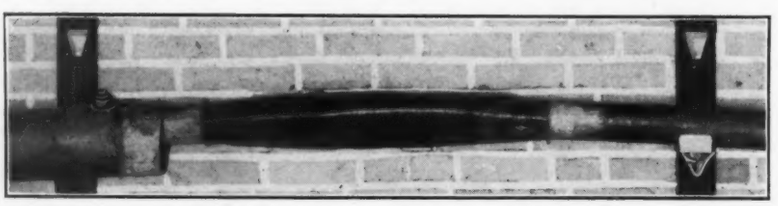

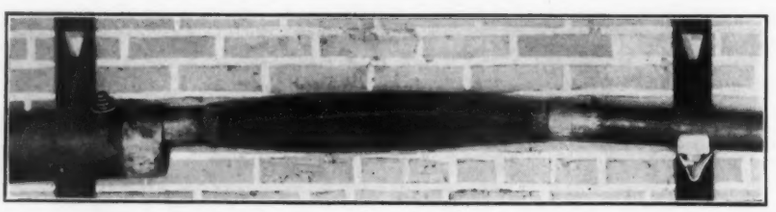

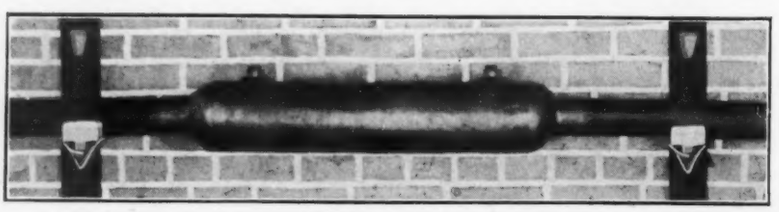

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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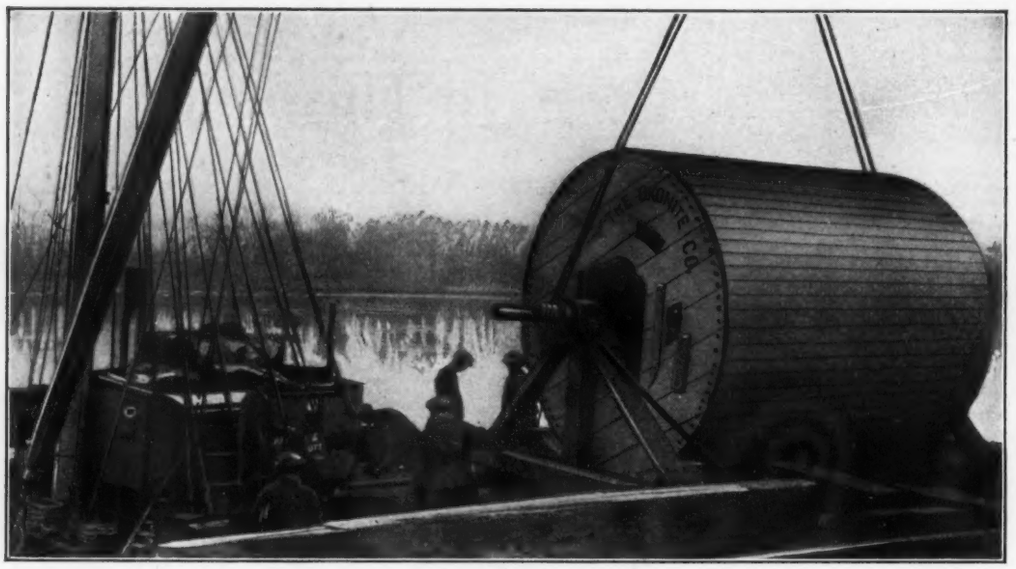
Human Aspects of Editing

THE white paper, the printed words and the drawings and illustrations tend to separate the editor and his reader and to prevent the intimate human contacts so essential to understanding and friendship. Composition is a formal enterprise hedged about with traditions of coldness, aloofness and artificial expressions.

Editors of the ELECTRICAL WORLD are human and know their readers are human. In the personal contacts of industry the editors and their readers call each other "Joe" and "Bill" and do not hesitate to express themselves frankly and freely. But there are so many editors and so many readers that these personal contacts are relatively meager and unsatisfying. The editors would like to know every reader and would like to talk politics, engineering, family matters and ELECTRICAL WORLD in an informal and intimate way. They would like to do this because of their joy in friendly human contacts and also because they need the counsel of readers to make a better paper.

Since personal contacts with all readers are impossible, however, the editors hope that readers will write them when occasion offers. They are pleased when readers make constructive suggestions for improving the ELECTRICAL WORLD, for the magazine is the readers' more than the editors'.

SUBMARINE POWER CABLE



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Electrical World

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Editor

VOLUME 92 — *New York, Saturday, November 10, 1928* — NUMBER 19

The National Election

HERBERT HOOVER'S victory in the national election on Tuesday was a triumph for conservative government, and although public utilities are not supposed to be in politics, it is no secret that they would have been disappointed had the result been otherwise. And with reason. The policy of the nation with reference to water-power development was settled with the enactment of the federal water-power act during the Wilson administration, and many states possessing water power patterned their legislation after the national law. For political and not economic reasons, however, water power was thrust in the campaign just ended. Notwithstanding the many and great hydro-electric developments which have been made since 1920, Governor Smith renewed his plea, never indorsed by his own state, for government ownership and operation.

This was one of his major planks, and that he was defeated by a man holding diametrically opposite views would indicate that the American people are still opposed to government in business. It should also put an end to some of the socialistic utility legislation now brewing and curb further attempts of government to interfere unjustly with American business. Mr. Hoover is on record with a philosophy of government that has for its keynote "Keep the government out of business," and because of his engineering and economic training he should be able to fix the present complex government and business relationships with skill and decision. He deserves the allegiance of the electrical industry in carrying out this policy.

If, as now appears evident, the complexion of the next Congress has likewise been changed, the electrical industry has every reason to expect an amicable settlement of the Muscle Shoals and Boulder Canyon controversies and the establishment of the principle of state regulation of public utilities more firmly than ever. Mr. Hoover has expressed himself explicitly and repeatedly on these questions and undoubtedly will use his influence in guiding legislative thought in that direction.

* * * *

Renewed Interest Manifest in Electrification

RECENT announcements of railroad and terminal electrification projects have an important bearing on the progress of the electrical industry. Electrification is the logical answer to the problem of how to handle heavy traffic on congested railroads and is the forward step taken by railroad officials after they have developed existing facilities to their utmost. A secondary impetus given to electrification comes from the pressure of public sentiment to get rid of the smoke nuisance at terminals and to speed up suburban traffic. Thus the renewed interest in electrification has both an economic and a social background.

From the point of view of the electrical industry both manufacturers and utilities will benefit from electrification. A major hundred-million-dollar electrification project such as that announced by the Pennsylvania Railroad means increased prosperity for many electrical manufacturers, because both the railroad and the utility purchases will include a wide range of products. Moreover, the fact that energy will be purchased from light and power companies is logical from the national economic point of view. Both railroads and utilities will benefit and fuel conservation will follow. An open-minded analysis of these projects will show that utilities can meet any competitive price for energy because they can give the continuous service demanded for a minimum increment in investment and operating costs.

* * * *

Temperature Limits of Underground Cables

TEMPERATURE elevation of insulation imposes a load limit on almost every type of electrical equipment. The range of permissible variation of temperature differs from one type to another. In high-voltage underground cables elevation of temperature is limited by two important considerations. The first is the expansion of the impregnating compound which stretches the lead sheath. The sheath, being elastic, does not return to its original dimensions on cooling, leaving a layer of gas between insulation and sheath. This gas layer ionizes with corresponding active chemical deterioration of the adjacent insulation. The Hochstaedter, or type H, cable, with thin metallic ribbon which follows expansion and contraction surrounding the impregnated paper insulation, has been developed to avoid this danger.

A second temperature limitation is in the rapid increase of power factor, and so of loss, with rise in temperature. If allowed to rise too far, these losses will develop local hot spots, leading to further increase of loss and extending eventually to deterioration and breakdown. These two types of danger have necessitated the limitation of the normal operating temperature of cables to values considerably below those pertaining to other types of equipment.

A third danger from temperature elevation is claimed by Hochstaedter and Barrat in a recent number of the *Revue Générale de l'Electricité*. They state that by observation on cables in service, by calculation and by special experiments they have found that the expansion of the inner hotter portions of cable insulation may result in elastic strains on the paper tape so great as to

tear the fibers and so result in failure. The coefficient of expansion of impregnating compounds is usually very much greater than that of the paper, and it has therefore been supposed that on expansion under temperature the compound flows through the paper without special strain on the latter. The contention of Hochstaedter and Barrat is that the compound of the outer, cooler layers is always too viscous to pass through the paper, which later therefore forms a barrier for the expansion of the inner, hotter layers. Their analysis of the importance of this effect indicates that the elastic limit of the paper will not be exceeded for maximum temperatures between 60 deg. and 70 deg. C. in the usual type of cable. Since these temperatures are rarely reached in normal service, it is not often that a good cable will be endangered from this cause. On the other hand, it is pointed out that in periods of overload this type of danger may arise unless due care be taken to restrict temperatures to the values mentioned.

* * * *

The Grounding of Portable Domestic Appliances

WHATEVER may be the decision of the industry as to the best method of grounding wiring systems within the premises of consumers, one point stands out clear-cut in the present discussion. The grounding of individual portable appliances in domestic service by the use of a third wire attached to the frame of the appliance should be avoided.

Such a grounding system would require three-wire attachment cords and three-wire plugs and receptacles and if adopted as the national standard, made mandatory by the code, would place a ban upon more than eighteen million installations where electricity is now in use. The result would be a veritable dilemma. The industry would be obliged to follow one of two courses. It would have to make a demand for the immediate rewiring of all these buildings—which is unthinkable because of the practical impossibility of accomplishing it—or it would have to proceed to wire all new installations for three-wire appliance connections, leaving the present consumers' equipment as it is. This would involve a complete duplication of fittings and appliances. Appliances could not be taken from a new house and used in an old one or vice versa. The priceless privilege of interchangeability would be lost. And the stocks of manufacturers, wholesalers and retailers of both wiring devices and wired appliances would be doubled, cutting turnover in half and producing economic chaos and utter confusion in distribution and merchandising. It would set back public acceptance of complete electric service ten years, and this is the final expression of the public service to which the entire industry is devoting itself.

The idea is so preposterous from the practical point of view that power companies, manufacturers, contractors and dealers are all denouncing it. Yet it is feared by some that such a calamity is threatened, because of the fact that the framers of the National Electrical Code, responding to a demand from some states and cities, are contemplating the grounding of portable industrial appliances. Protection in the home should be first sought through security in the insulation of cords and appliances and prevention of the use of dangerous sub-standard equipment. Moreover, it is a question whether or not such a ground wire in an appliance cord would not constitute a hazard in itself, since the householder in repairing a broken cord might easily reconnect a plug improperly and attach the hot wire to the frame.

The grounding of portable appliances in industrial use is one question. It can be decided on its merits in the public interest. If domestic appliances in use today are overhazardous, then they must be made safe; but it need not be done by condemning all the existing residence installations in America.

* * * *

The Coming Public Hearing on the Code

MANY revisions have been made in the 1928 edition of the National Electrical Code. Some disagreement exists within the industry concerning certain grounding provisions of the new code. An open hearing will be held in New York on November 15 preliminary to its adoption as an American standard by the American Standards Association. Here is the opportunity for a broad and free discussion of the whole subject, and it is to be hoped that there will be a large attendance of all concerned and that the hearing will bring about agreement.

After several years of earnest effort by competent representatives of engineering, industry and government, the American Standards Association has been established and accepted as the national standardizing agency. The organization has been perfected and its procedure clarified. It is now ready to function in the common interest. Nothing should be allowed to jeopardize this orderly and constructive machinery for standards and code making. On the contrary, every endeavor should be made to advance the prestige of the A.S.A. and to make it operate smoothly and effectively as a clearing house for the development of standards. The present code problem gives a fine example of the need for such an authority.

For many obvious reasons the National Electrical Code is vital to the electrical industry. It stabilizes industry evolution. It helps industry progress. For many years it dealt primarily with fire hazards only. Recently safety elements have been incorporated, and this has led to difficulties in code rule formulation. For safety is an intangible term difficult to define in dollar values, and field data to substantiate claims for safety construction are hard to obtain. Moreover, there is no direct casualty insurance basis for measuring investments for safety in the economic terms possible with fire insurance ratings. The result is that further developments in experience must be awaited before many safety rules can be made tangible and established by acceptance for general application. Naturally all electrical men desire the safest possible construction and the most foolproof installation methods compatible with economic and service considerations. But this principle at present is difficult of codification because there exist so many differences of opinion.

As is the case with all joint industry considerations, the solution to the code problem must be predicated on the best service to the public consistent with recognized technical and commercial factors. Such a solution is only achieved by the most patient study and the most tolerant regard for the viewpoints of the conflicting interests that are sometimes inescapable. Agreement is, besides, often only possible through practical compromise by which group purposes are reconciled without the sacrifice of basic principles. It is to be hoped therefore,

that those industry representatives who meet next week at the New York hearings will approach the situation in the frame of mind that weighs all elements in a spirit of good will. Such a disagreement is, after all, but an episode in the broad constructive development. It should not be permitted to jeopardize settled industry procedure, harmonious industry relations or consistent industry progress.

* * * *

The Series Capacitor

USE of a series capacitor for the neutralization of line inductance represents a new accomplishment in improving further the performance and efficiency of relatively short transmission projects. The use of a condenser in this type of circuit is not to be confused with its use in shunt for the power-factor correction of inductive loads or for supplying the charging current of long-distance lines, as accomplished by the synchronous condenser.

In an installation recently reported the use of series capacitors in one side of a transmission loop has materially raised its permissible current, and therefore its power capacity, which formerly was limited by the inductive reactance drop. One of the most striking features of this new equipment is the commercial production of a relatively high-voltage, low-power-factor condenser. The dielectric is impregnated paper. The limitations of this type of a dielectric are well known.

That manufacturers are ready to offer for continued high-power service condensers of this type is a distinctly forward step and gives promise for a still wider utilization of the important properties of capacity in relation to inductive circuits. The problem of the dielectric is not yet completely solved, however, as is evidenced by the somewhat elaborate protective apparatus which is necessary in conjunction with the series capacitor in the installation referred to.

* * * *

Promotional Rates and "Luxury" Lighting

USERS of electrical energy in homes served by a single meter and a promotional-type rate are rapidly earning the convenience and cheapness of liberal illumination. Lighting occupied rooms electrically in residences ceased to be a luxury many years ago in most places enjoying a fair density of population. Now we are entering an era in which unoccupied portions of the home can be supplied with long-hour illumination at a low increment cost to the householder, and near at hand can be seen the time when the artist, the interior decorator, the architect and the engineer will put the whole matter of attractive and utilitarian home lighting on a new plane of satisfaction and profit to all concerned, turning what is still a sporadic advance into a general popular movement.

The increment cost to the householder of maintaining long-hour lighting in such places as porches, hallways, bathrooms and cellars is worth looking into from the central-station viewpoint. In a recent instance the use of two 25-watt porch and step lamps from dusk to bedtime, the operation of a 25-watt hall lamp over the same period and the burning of a 15-watt cellar lamp 24 hours per day was estimated to add the equivalent of another average residential customer to the system. The householder defended this liberality of use on the ground that his increment cost was but 2.7 cents per kilowatt-hour above his base consumption of 50 kilowatt-hours per month, starting at 7.2 cents net. For about 70 cents per month, in other words, this additional service was enjoyed, and the point was made that the added revenue was obtained without any appreciable increase in capital charges.

It is unnecessary to pass upon the thrift aspect of the case or to comment upon the minute accuracy of the estimate of annual energy consumption for the purposes named. The point of this illustration from a New England town is to show the value of a promotional-type rate which offers additional service at an increment cost encouraging long-hour use of electricity for whatever convenient purpose or whim. By such means the word "luxury" is being expurgated from the glossary of electric service in the home.

* * * *

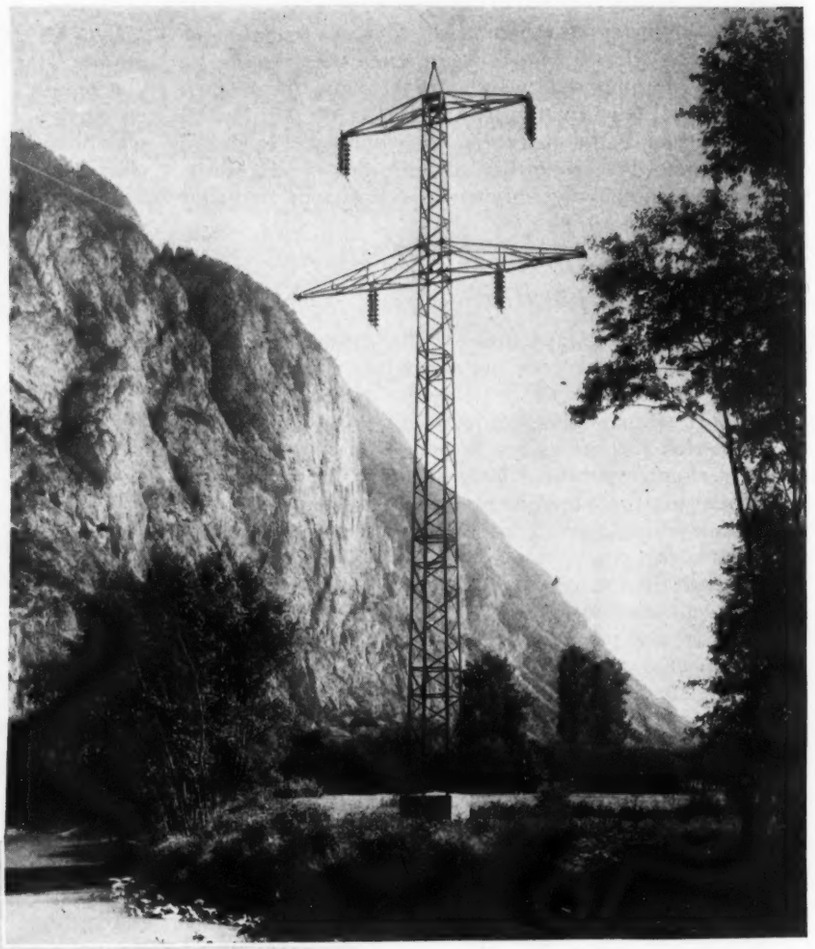
Use of Carrier Systems Increasing

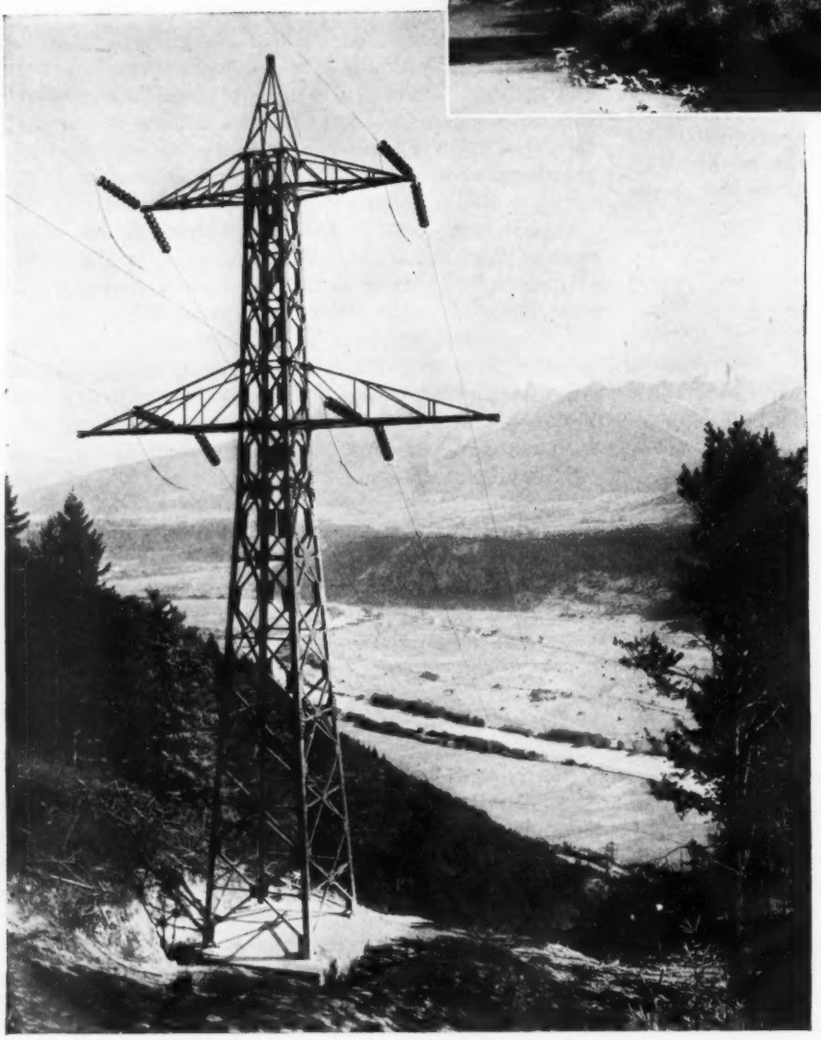
CARRIER telephony is now working satisfactorily along a number of transmission lines and in many cases is reported to give better service than a private telephone either on a separate pole line or on the transmission tower. Yet, the anticipated widespread use of the carrier system has not taken place. Most of the utilities are still depending on telephone circuits, and new telephone lines are being built even today along transmission lines.

The advantages claimed for the carrier system have been brought out in many publications and discussions and are well known to the utility operator. None the less, he seems to be skeptical and is slow to use the carrier system in spite of the great saving in investment as compared with a telephone circuit. The general reluctance of the practical man to accept new ideas can be accepted only as a partial explanation of this sluggishness. There are many other reasons. In numerous instances of carrier installation it took many weeks or even many months of experimenting before the carrier operated satisfactorily. This delay was often due to the attempt to reduce the energy to a minimum, forgetting the fact that a public utility man does not care whether it takes half a watt or one kilowatt so long as he gets satisfactory operation. Furthermore, carrier telephony can only be made available for use after the construction of the lines and stations is completed, whereas a telephone circuit can be made ready and used during the construction period. The patrolman portable carrier sets have only recently become available; they can be used only at certain fixed points, and communication by them is limited to about 30 miles, whereas a lineman can climb a pole at any location, hook on his handphone to a telephone circuit and talk to any place on the system. The hope that by means of carrier current it would be possible to talk through a broken line, thus offering an important advantage over telephone circuits, has not yet been fulfilled.

Carrier telephony will no doubt make steady progress, but it will have to undergo considerable additional development before it will replace a good telephone system. Carrier systems should be used more frequently as second-line communication agencies and in certain applications where telephone service is uneconomical or unavailable. It is through use and development that carrier systems will be perfected—a highly desirable result.

Bavaria and Austria Interconnected





Germany is making rapid strides in interconnection by using high-voltage lines to connect hydro and steam stations. The accompanying illustrations show the 125-kv. line connecting Bavaria and Austria as it appears in the Tun Valley near Lire.

Resonant Control Adopted

Boston Edison has applied this principle to multiple street lamps. Features of equipment and operating experience are given

By William W. Edson

Station Engineering Department,
Edison Electric Illuminating Company of Boston

A COMMERCIAL installation of resonant remote control for multiple lamps in street service was placed in operation last spring by the Edison Electric Illuminating Company of Boston in connection with the lighting of the new Southern traffic artery from the company's Dorchester substation. The results have been excellent from the standpoints of reliability, convenience and economy, and the engineering features of the installation are of considerable interest.

The initial lighting of this boulevard requires about 100 Westinghouse Sheridan hollowspun granite standards, each having a 750-watt lamp. A bronze box in the base of each pole contains the lamp relays. This district is supplied by a four-wire, ungrounded neutral, 4,000-Y/2,300-volt, 60-cycle service. The substation is fed from the 13,800-volt system by three 1,500-kva., one 5,250-kva. and one 7,500-kva. transformers.

The system used was developed by engineers of the Westinghouse Electric & Manufacturing Company in connection with a preliminary trial installation for the New York Edison Company.

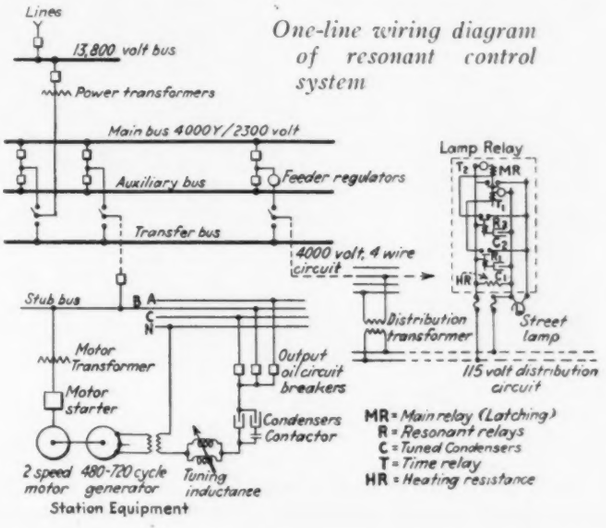
The lamps are turned on and off respectively by two medium frequency currents, superimposed on the 4,000-volt bus at the substation, these currents going to the lamps through the regular power circuits. Each lamp is connected in parallel to the nearest available 115-volt distribution circuit.

Advantages of Parallel Connection

The parallel connection of lamps has long been desirable except in very sparsely populated districts since it permits using existing distribution transformers and circuits. Costly high-tension series street circuits and special constant-current transformers thus become unnecessary. The high maintenance charges for these series lines are eliminated. Another disadvantage of the series circuit is that any open circuit such as may be caused by a collision between an automobile and a lamp post will cause the 60 or 70 lamps on that circuit to be extinguished, whereas with the parallel arrangement a failure of one lamp has, of course, no effect on the others. The series circuit must be treated with respect at all times, whereas the parallel scheme has only low potential on the lamps, poles and circuits. A further point in favor of the parallel arrangement is that a lighting circuit may be installed for a new street and be available for house lighting as the district develops.

Individual lamps have been installed with manually operated switches, but obviously these are impractical for any extensive installation. Time clocks are frequently used for a few remote lamps, but these clocks if equipped with motor drive and astronomical dials are quite expensive. A main disadvantage is that they are not under the control of the station operator and thus will not meet special weather conditions or schedule changes.

Pilot wires leading from the control station to the various lamps give manual control, but in general the cost of installing the control wires and relays is nearly as expensive as the series circuit. The system is usually arranged to "fail safe"; that is, the lamps turn on if the pilot wires are in trouble, but during this time the operator no longer has control of the lamps.



One-line wiring diagram of resonant control system

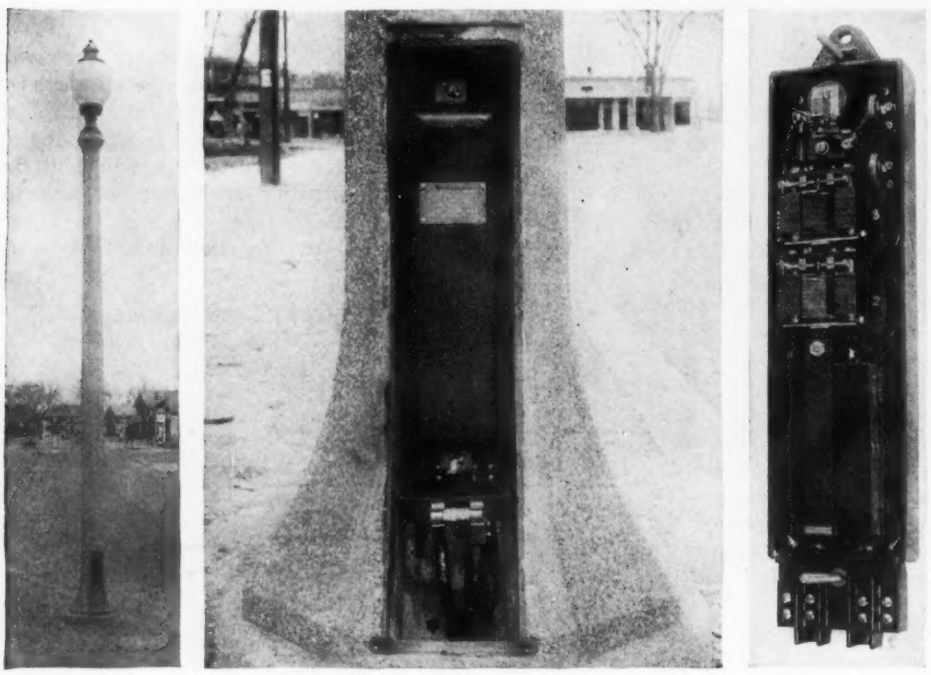
Resonant Control System

The resonant control system appears to meet most of the above objections to the parallel installation. The operator has complete control at all times; the lamps are independent of each other; special wires, circuits or lightning arresters are not needed, and individual lamps can be added when and where desired. Of course failure of the station-controlling equipment would be serious, but such a failure is very remote as the apparatus is only in service a few minutes a day and so escapes any wear and tear or shocks on the system. There is plenty of idle time for maintenance. The sta-

tion equipment is expensive, but its cost is decidedly smaller than several constant-current transformers and series street circuits. The relays at the lamps are very reasonable in price; in fact, it is cheaper to use a relay per lamp than to group several lamps on one control relay.

Station Equipment

As shown on the schematic diagram, the station equipment consists essentially of a two-speed motor-generator arranged to be connected to the main, auxiliary and transfer buses respectively. This generator delivers 720 or 480 cycles per second to the entire system connected to these buses. These high frequencies travel along the 4,000-volt circuit, through the distribution transformers and to the various street lamps. At each lamp there are two relays tuned to respond only to these respective frequencies. These, in turn, close or open a latching relay which controls the lamp itself.



750-watt multiple lamp with resonant control, relay box in base of hollow spun pole and close-up of relay box opened

To turn on the lamps the stub bus with the motor power transformer is connected to the main station bus, and the operator then presses a 720-cycle motor control button. This connects the high-speed winding of the motor to the power transformer through a starting compensator mounted on rear of the contactor panel. After approximately twenty seconds the time-delay opens the motor starting contactor and closes the run contactor. The motor-generator set now comes up to speed.

The operator closes a phase A push button, thus connecting the generator between neutral and phase A of the system. It will be noticed that there is a condenser and a variable inductance in series with the generator. These are so calibrated with the rest of the system that the total impedance is a minimum; i.e., the high-frequency output current becomes a maximum. This arrangement also prevents an objectionable amount of 60-cycle power from flowing back into the generator. The coupling transformer physically separates the high potential from the generator, thus allowing it to be wound with low voltage insulation.

One of the voltmeters is arranged to damp out the 60-cycle voltage on the line and to read only the high-frequency voltage available for operating the lamp relays. If the voltage is too small the operator can obtain better resonance by varying the position of the motor-driven tuning coils, similar to tuning in on a radio, or he can raise the generator voltage by cutting out field resistance. After the proper voltage is obtained the current is left on for about fifteen seconds to insure that all lamps are operated. Phases B and C are then similarly energized in succession, no further adjustments being necessary for these phases. The machine is then shut down.

In the morning the same sequence is followed except that the motor is operated at the slower speed (480 cycles). It will be noted that the entire operation does not exceed two or three minutes to control any number of lamps which may be on the various circuits fed by this substation.

Lamp Equipment

The equipment at each lamp controlled consists essentially of two relays tuned through condensers to respond respectively to the two frequencies. These relays, in turn, close or open a latching type main relay which energizes the lamp. A small heating resistance is used to prevent condensation. Failure or restoration of the power circuit will not affect the position of this main relay. A simple timing device is so connected that the resonant relay must be energized for at least five seconds before the lamp relay will operate. This prevents improper operation due to lightning or switching surges and also allows more latitude in the adjustment of the relays. All of these relays are designed to withstand street vibration.

The safety features of the station equipment include four overload relays on the breakers feeding the stub bus, a thermal time-delay device to shut down the set if excessive time or current is used in starting, undervoltage release on the motor and various interlocking circuits. For example, the start and run and the high and low speed contactors for the motor are mechanically and electrically interlocked. The three single-phase output breakers have two types of mechanical interlocks and are interlocked electrically at the push buttons, auxiliary relays and the closing contactors. Potential transformers are connected to the condensers to drain their charge when not in service.

There are four meters, the high-frequency voltmeter mentioned above, a generator voltmeter, a line output ammeter and a generator field ammeter.

Rating of Apparatus Used

Power transformer for motor—50 kva., three phase, 60 cycle, 4,000 volt Y/230 volts.

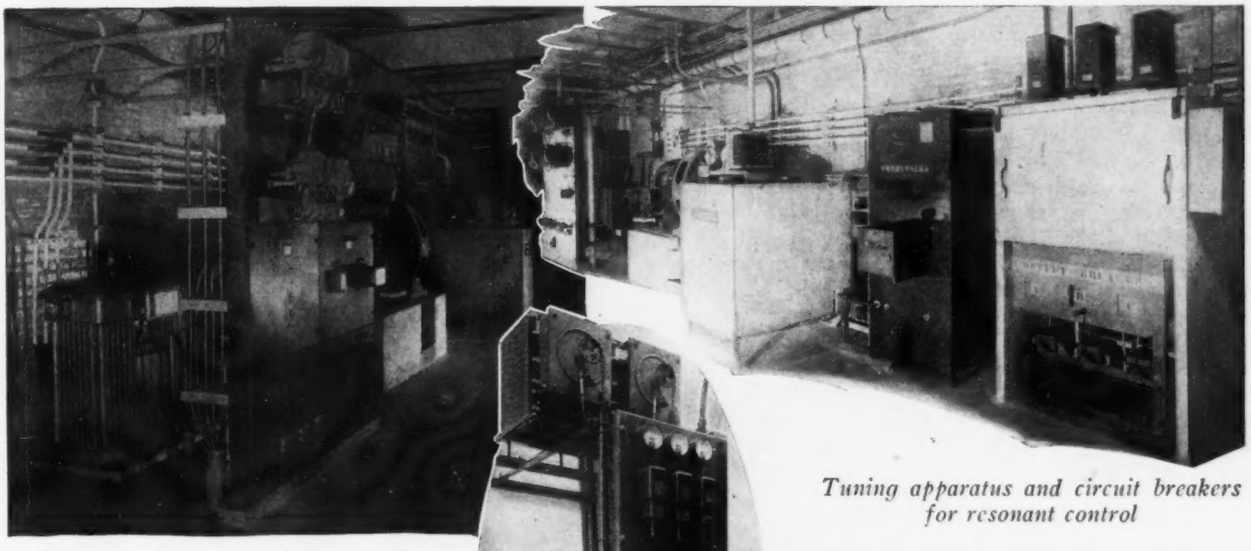
Motor—100 hp., 220 volts, 1,750 and 1,160 r.p.m.

Generator—50 kva., 100 volts, 288 amp., three phase. At present this unit is operated single phase and is switched to the three line phases in succession as this arrangement requires only one-third the condenser capacity. The generator will stand considerably higher voltage, but so far the load averages about 90 volts and 120 amp., so that there is plenty of capacity available for future growth of the station.

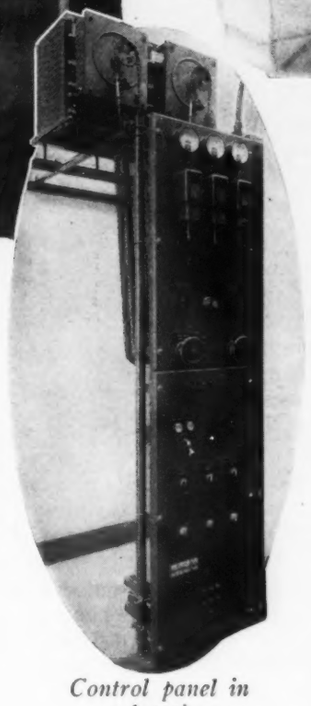
Coupling transformer—25 kva., single phase, 1/1 ratio with 150 and 4,600-volt windings. Taps are available to meet various line conditions. At present there are 30 turns on the primary and 25 on the secondary winding.

Tuning Coils—200 amp., 2.1 millihenries per coil with 60 per cent taps, now connected with the two coils in parallel and aiding each other, all turns of each being used. The impedance is about 50 per cent higher on the 720 cycles than for the 480 cycles. The coils are on a carriage which is motor-operated so that the distance between them can be varied from the switchboard.

Condenser—24 standard condensers as used for power-factor correction. Each is 8.5 mfd. at 60 cycles, 1,400 volts. These are connected in parallel groups of two each, fourteen being used for the 720 frequency and all twenty-four for the 480 cycles. A contactor automatically switches in these condensers for the lower frequency.



Stub bus, motor transformer and contactor panels in substation



Control panel in substation

The 100-volt high-frequency potential is superimposed on the 2,300-volt, three-phase transmission system. The 2,300/115 distribution transformers step this down to five volts, which is available for operating the lamp-tuned relays. This 5-volt increase, however, does not appear as such on the customers' circuits as the total voltage is 115.1. This 5 volts is ample to operate the resonant relays if they are properly tuned, since the impedance is reduced to the coil ohmic resistance. Of course no circuit is perfect, and if excessive 720-cycle voltage is applied the 480-cycle relay will operate, but this condition has been met only on test. Actually, this broad tuning is an advantage, as more latitude is allowed in design of the relays and in variation of the speed of the motor-generator. The voltage margin on the relays at their proper frequency is unusually wide, which of course increases their reliability of performance. They will operate satisfactorily between 2 and 10 volts, inclusive.

The design of the station-tuning equipment depends on the characteristics of the system as sufficient inductance and capacity must be added to make the total impedance a minimum. The proper tuning follows the formula $\sqrt{Lc}$, therefore in making the initial adjustment, if it is found that the output current is increased as the inductance coils are brought together, it is necessary to go to the full winding tap on the coil or to connect in more condensers. Of course some "juggling" is necessary to obtain proper tuning at both frequencies. As stated, extra condensers are automatically switched in to compensate for the changed tuning due to the lower frequency.

Tuning apparatus and circuit breakers for resonant control

The output current from this equipment has two types of paths from the bus, one through the induction regulators and feeders to the distribution transformers and thus to the load and relays and the other back through the power transformers feeding the bus. The latter represents a loss which increases as the size or number of power transformers is increased. The equipment must be flexible enough to prevent overvoltage in one extreme and yet be sufficient to operate the relays with full bus capacity. The first case is frequently met when a grounded circuit is on the auxiliary bus with a 1,500-kva. transformer. Actually, this loss through the power transformers, while it will increase the generator current, does not materially affect the voltage and is not serious as the equipment operates satisfactorily from 1,500 kva. to 17,250 kva. transformer capacity on the bus. A test on the high-tension side with the high-frequency voltmeter gave only 0.2 volt, which indicates that very little control voltage is present in the 13,800-volt system.

The installation and operating troubles have only been of a minor nature and were easily corrected. One of the potential transformers to drain the condensers overheated and caused considerable speculation at first, but

a new transformer is working satisfactorily. An accidental ground on the condenser contactor gave some odd results in connection with a grounded feeder, but the trouble was found and corrected. During the initial testing the voltage was inadvertently made too high and both resonant relays of several lamps closed, thereby causing the lamp relay to vibrate. No harm was done except that some of the relay fuses were burned out. A few of the lamp relays were found to be blocked in the open position by varnish or due to improper spring adjustment.

Maintenance and Inspection Charge Have Been Low

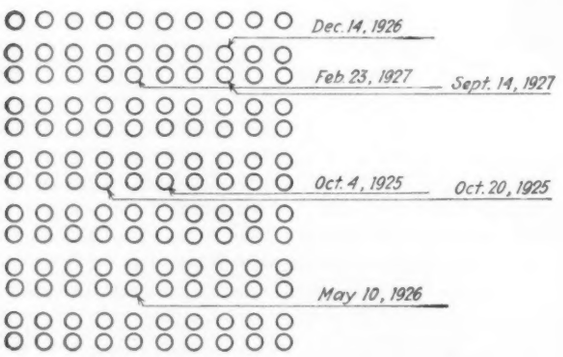
The maintenance charges so far have been negligible. Inspection is simple, as the station equipment is "dead" most of the time and the lamp relays are only 115 volts. The fuses and coil circuits of the latter can be checked by removing the main cartridge fuse and tapping it against its clips. The resonant relays should click at each closing of the circuit. The timing devices, main lamp relay and the lamp circuit can be checked by holding closed the contacts of the resonant relay for about five seconds.

This resonant control equipment has been in operation for several months and has been found entirely reliable. It appears to offer interesting possibilities for districts having a large street-lighting load supplied from one station.

Boiler Tube Record

RECORDS of maintenance of boiler tubes are simple affairs in the steam plants of the Detroit Edison Company. In each plant the maintenance engineer has bound in a book a set of white prints of horizontal sections of the boilers under his charge. The sections are taken through the tube banks and consist, as indicated by the illustration, merely of small circles arranged according to the disposition of the tubes in the particular boiler.

Enough white space has been provided on the print



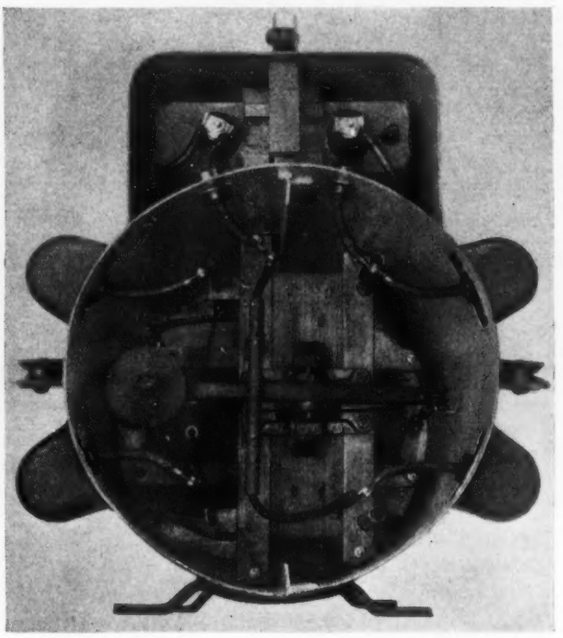
Maintenance record of boiler tubes

so that there is room for entries of records. The entries are dates, nothing more. The color of ink with which they are written indicates whether the tube was rolled, replaced or what not. These are only a limited number of things that can be done in maintaining boiler tubes and a sufficient number of colors of ink can always be found to cover them.

Street Lighting Power Factor Corrected by Capacity Transformer

BY A unique combination of capacitors and transformer mechanism in the same tank General Electric Company engineers claim to have been able to produce a constant-current transformer having a unity power factor primary at full load, thus overcoming a major complaint of central stations against this type of transformer for street-lighting service.

The new transformer, known as the type ROC, consists of a combination of capacitors and the standard RO transformer. The capacitors are connected in multiple across the primary. Because of the inherent characteristics of capacitors it was found that they could not be installed in the same oil as the transformers, hence they are housed in a container welded, in the case of the standard 10-kw. size, to the front of the transformer tank. In this way the best possible shape for pole mounting is preserved.



Street-lighting transformer and capacitors in single tank

The 10-kw. combination has a 2,300-volt primary and a 6.6-amp. secondary. Other sizes include 15, 20, 25 and 30 kw. for pole mounting, and 7.5, 10 and 15 kw. for subway use.

Tests with the 10-kw., 2,300-volt, 60-cycle type ROC transformer have given the results show in the following table:

Power factor at maximum load, with condensers (This value is leading, and is provided purposely so that the power factor at around rated load is 1.00)	0.97
Power factor at maximum load, without condensers	0.81
Power factor at one-half load, with condensers	0.91
Power factor at one-half load, without condensers	0.40
Input or primary current, maximum load, with condensers, amperes	5
Input or primary current, maximum load, without condensers, amperes	5.97
Input or primary current, one-half load, with condensers, amperes	2.68
Input or primary current, one-half load, without condensers, amperes	6.07

Efficiencies approximately the same with or without capacitors.

Improved Handling of Insulating Oil

By H. A. P. Langstaff
Relay Engineer West Penn Power Company, Pittsburgh, Pa.

OWING to the installation during the last few years of large outdoor circuit breakers to replace inadequate indoor circuit breakers and to the natural growth of the system of the West Penn Power Company, the quantity of insulating oil used at many stations has increased from twenty to twenty-five times. This greatly increased use of oil has resulted in a demand for facilities to maintain the oil in a clean, dry condition, as well as to handle it quickly and efficiently and to provide storage for good oil which could be available in emergencies. It has been found that close inspection and filtering of the oil as soon as necessary have resulted in greatly decreasing the circuit-breaker failures in the stations of this utility.

An investigation of the transportation cost for insulating oils showed the average haul from maintenance headquarters to the substations to be about 20 miles and that the cost of hauling is $\frac{1}{10}$ cent per mile per gallon, so that it was decided to do as much oil purification as possible at the substation. It was also found that the cost of storing a small quantity of oil at each centrally located distribution station would not be excessive when compared with the hauling and additional filtration necessary when handling oil from the maintenance headquarters. The accompanying tabulation offers a basis for the provision of facilities for any station.

To eliminate difficulties which had been experienced in the past, certain features were adopted, such as: Two tanks or a double compartment tank for the separate handling of clean and dirty oil; drain valves at the bottom and manholes at the top of the tanks to facilitate cleaning; the use of a float connected to a flexible steel hose inside the tank so that the oil will always be drawn from near the top surface, thus aiding the process of filtration; gages for the measurement of the quantity of oil in the tank, and use of reversible pumps which add to the convenience of operation.

RECOMMENDED OIL-HANDLING PRACTICES

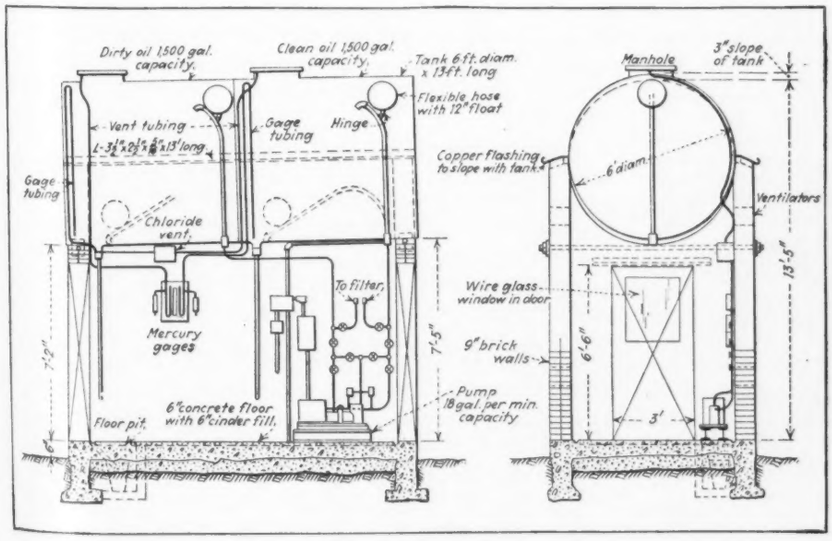
	Remote Small Stations	Small Distribution Stations	Moderate Size Station	Large Station
Gallons of oil used at station	Up to 1,000	1,000–10,000	10,000–30,000	30,000 or more
Number of tanks	0	2	2 to 4	2 to 6
Voltage of station, kv	Up to 37	Up to 37	37 to 66	66 to 220
Size of clean oil pipe, inches	0	1	1½	2
Size of dirty oil pipe, inches	0	1	2	2½
Capacity of pump, gals. per minute	0	10–20	20–40	40–80
Capacity of filters, gal. per hr.	0	200–300	300–1,000	1,000–1,500
Maximum quantity of oil in one circuit breaker, gal	500	500	2,000	7,000
Type of filters	Portable	Portable	Portable or stationary	Stationary
Type of pumps	Portable	Portable or stationary	Stationary	Stationary

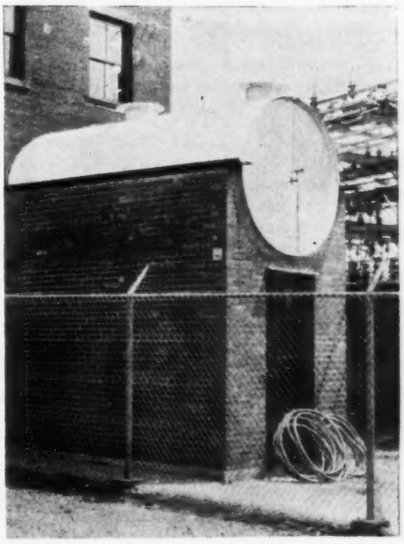
All reasonable efforts have been made to eliminate the possibilities of condensation principally by installing new tanks above ground and arranging the underground tanks so that all parts of the outer surface are exposed to a uniform temperature. Centrifugal filters and blotter presses have been provided at the larger stations operating with a primary voltage of 132-kv. These filtering outfits, as well as the ones for use at the 25-kv. and smaller stations, are portable units. Those purchased most recently have the blotter presses mounted on the same truck with the centrifuge. This affords considerable advantage not only in moving the outfit but in setting it up and operating it.

Cost of Industrial Transformer Bank

(1927 Job)

Three General Electric H-60-200-2300/4000 Y-2300 KS transformers	$2,218.05
Lumber	31.47
Six 200-amp. link fuses	5.28
Miscellaneous	16.22
Hauling charges	149.75
Local labor	103.79
Insurance	3.93
Transportation	26.94
Engineering services	152.44
Other miscellaneous small items	0.47
Total	$2,708.34





Divided tank with surface draw-off simplifies oil handling

A flexible steel hose permits attachment to any item of equipment with minimum permanent piping and quick action

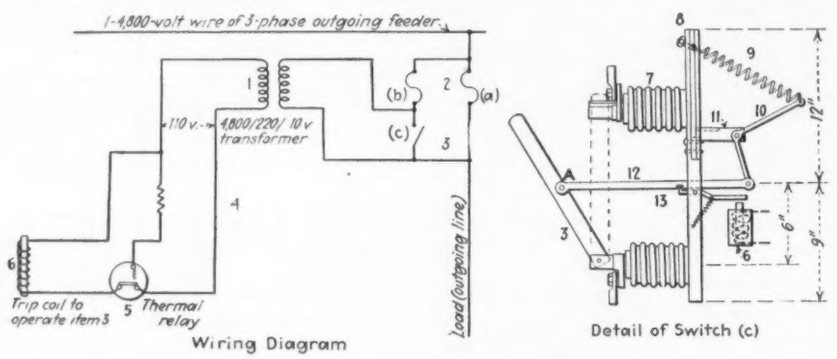
Automatic Re-Fusing Device Used on Milwaukee System

By O. M. Ward,
Superintendent of Operation
Milwaukee Electric Railway & Light Company

A DEVICE for automatically restoring service to a feeder without utilizing comparatively expensive automatic reclosing oil circuit breakers has been developed and put in service by the Milwaukee Electric Railway & Light Company. Service restoration is accomplished by using a combination of fuses and knife switches which automatically re-fuse a circuit when service is interrupted on account of a main protective fuse being blown. Two such installations were made during 1928, both at 5,000-volt outdoor substations and each on a single three-phase feeder.

How the Device Functions

Two standard 5,000-volt line fuses, (*a*) and (*b*) on the wiring diagram, are used on each phase of the feeder. The rating of these fuses depends upon the load connected to the feeder. Normal feed is through fuse (*a*), switch (*c*) being open with the primary of the operating transformer (1) connected across its terminals. As long as fuse (*a*) is intact, no voltage is impressed upon the primary of the operating transformer. When fuse (*a*) blows, voltage is impressed upon the operating transformer primary, the value of this voltage depending on whether the fuses have blown in one or more phases, upon whether or not the system is operated with a grounded neutral and upon the character of load connected to the feeder. On a 5,000-volt, three-phase ungrounded system (the type of system on which these devices are being used) the voltage across the terminals of switch (*c*) when fuse (*a*) is open may vary from 100 per cent to 30 per cent of normal circuit voltage.



Scheme of operation and design of automatic re-fusing device in use on Milwaukee system

As soon as the operating transformer is made alive current flows through thermal relay (5). After a predetermined time this relay completes the circuit from the secondary of the operating transformer through the trip coil (6) of switch (*c*) and the trip coil plunger strikes the latch (13). This releases rod (12), which is attached to the blade of switch (*c*) and one end of bell crank (10). The other end of the bell crank is attached to spring (9), which, when rod (12) is released, causes the switch blade to close. When switch (*c*) is closed fuse (*b*) is cut into the outgoing line and service is restored. After fuse (*a*) has blown and the service has been restored through fuse (*b*) normal operating conditions may be restored by re-fusing (*a*) and opening switch (*c*).

Switch (*c*) and its operating mechanism are inclosed in a sheet iron casing which protects the equipment from the weather. The trip coil is of special design, as it must operate over a wide voltage range. However, voltage is impressed on this coil for only a fraction of a second, and there was no difficulty in designing a coil that gives satisfactory service. Twenty-ampere plug fuses are connected in the trip circuit to protect the operating transformer in case the mechanism fails to function properly. A wood rod attached to the upper end of bell crank (10) hangs through a small opening in the bottom of the sheet iron inclosure. This rod indicates the position of switch (*c*) and this, in turn, indicates whether or not fuse (*a*) is blown.

In the majority of cases service interruptions due to line troubles are ended by one reclosure of an oil circuit breaker where oil circuit breakers are used. This fact prompted the idea of restoring service automatically by means of fuses. It is not intended to have this scheme replace automatically reclosing oil circuit breakers on important circuits. However, on circuits where the load is such that the expense of an automatic reclosing oil circuit breaker is not justified the re-fusing device answers the purpose very well. This is particularly true where the installation is located at points where frequent inspections entail practically no additional expense. The only purpose of these inspections is to note whether or not the switch which short circuits fuse (*a*) has operated. Any one passing the substation can make this inspection, with practically no loss of time.

Overhead circuits that are maintained in good condition have but few interruptions to service, and these interruptions occur mostly during lightning storms. Ordinarily, a well-maintained three-phase circuit serving rural territory should have not more than one or two interruptions in a month during the lightning season, and no interruptions during the winter months. The re-fusing device installation can be put in service at about 30 per cent of the expense necessary to install automatic reclosing oil circuit breakers. It is expected that the service given by the re-fusing device will be almost as good as that given by standard reclosing oil circuit breaker stations, and the maintenance expense of the re-fusing installation will be considerably less than the maintenance that is necessary for oil circuit breaker substations.

The two three-phase re-fusing devices now in service were installed in June, 1928. Although they have both operated through the summer of 1928, only one of them has been called upon to function, and this one only once. Its operation at that time was entirely satisfactory and no difficulties are anticipated in the use of this equipment in the service for which it was designed.

Materials Needed for Automatic Re-Fusing Device

Item No.	Description
1	Standard distribution transformer, 1½ kva., 4,800/220/120 volts.
2	Standard Line Material Co. throttle fuse.
3	Disconnecting switch for 5,000-volt, 200-amp. Made at Coldspring shops.
4	Resistance.
5	Standard thermal relay.
6	Standard trip coil
7	Standard post type insulator.
8	4-in. steel L switch base.
9	Compression spring (steel).
10	Bellcrank (steel casting).
11	Steel angle support for bellcrank.
12	Fiber or bakelite round rod tested for 7,500-volt insulation.
13	Brass trigger.

The Public Interest—

Its Place in the Formation of Industry Policies

Joint industry action can be had by using public good as a guide to the formation of industry mechanisms. Current problems surveyed and solutions proposed

By ALFRED E. WALLER
Managing Director National Electrical Manufacturers' Association

PUBLIC confidence and good will obtained by good equipment and good service establish the prosperity of any industry. If the public interest is used as the policy approach to any industry problem and if this interest can be clearly and concisely stated it is possible to construct policies and programs that are sound and workable. With public interest as a background, the essentials to progress are men with open minds, armed with facts and mentally fitted to put facts to work through existing or obtainable industry mechanisms.

Alfred E. Waller

The sincere and unbiased use of facts by those who are qualified to build policies upon conditions as disclosed is of the first importance. There comes a time when every policy or tradition has served its purpose. If examination shows that worn-out methods are in use, these shou'd be replaced by others which are adequate.

It may be profitable to examine a few typical problems of the electrical industry from the viewpoint of the public interest, to see the conclusions which follow, the policies which are now in force and the action which is now being taken to bring about improvements. One of the most important problems relates to quality and interchangeability. It may be stated as follows:

1. It is in the public interest that electrical apparatus, supplies and appliances should be of the highest quality consistent with economy and should be useful in all parts of the country.

The fact that the American public today enjoys the fulfillment of this statement is due to the excellent functioning of a truly remarkable group of voluntary associations. Co-operation, self-government and self-discipline are operating to a quite unusual degree in the electrical industry. Electrical manufacturers, through voluntary associations, have made a priceless contribution by establishing and maintaining the quality, interchangeability and safety of their various products. The central station, or public service group, has unified distribution voltages and frequencies and has adopted policies relating to the public interest to an extent which is without parallel in any other country in the world. With the development of industry, the separate trade associations found it desirable to co-ordinate their work on problems that were common. They also found that other industries than the electrical industry were concerned with many of the problems they were attempting to solve. It was a logical step, therefore, to set up a national or interindustry type of organization as a mechanism for bringing together the several trade associations and other industry groups. And the basis of the national authority on these matters was the use of the public interest as the guiding compass. The manufacturing and the utility groups, through their trade associations, joined many other groups in establishing the American Engineering Standards Committee as the outstanding authority on matters relating to engineering standards. The desire was to give the standards of all related groups a national aspect, and in order to do this it was obviously necessary to provide for participation by the general public, as a major interest. The American Engineering Standards Committee was organized to do this, and is satisfactorily fulfilling its purpose. Its deliberations, relating to technical questions, are carried on by technical committees, in which there is a balanced presentation of producer, consumer and general or public interest.

The safety, quality and interchangeability of electrical products are thus accomplished by a mechanism of technical groups, the outstanding product of which may be stated in three words, standardization, simplification and co-operation.

2. It is in the public interest that no sub-standard and hazardous material should be for sale or in use.

To a large extent this situation is true today, but there is still a certain amount of sub-standard material manufactured and sold, and its elimination is a serious problem for the industry as a whole. It requires the co-operation of the groups already mentioned and that of the general public as well.

Sub-standard material appeared as a result of competition by existing manufacturers and the entry of

others who had no technical knowledge or qualifications into the electrical field. From the manufacturers' point of view the problem is serious, because it is not possible for them, legally, to agree that sub-standard and hazardous material will not be made.

The regular process by which material of this kind can be gradually eliminated requires a co-ordination of effort by a number of parties at interest in the following manner:

Only the state or municipal authorities who have police power in a community can prohibit the use of sub-standard and hazardous material within its boundaries. In order to effect the exclusion of sub-standard material the police organization must have proper authority, and this is usually given by a statute or ordinance. It is not practicable to formulate ordinances which will set forth in detail all of the necessary requirements relating to electrical installations and materials. The direct and efficient method is to have the ordinance refer to a code, and to provide the means for keeping the code constantly revised and in conformity with the best engineering practice.

A code designed for this purpose must be one which has national standing and is constantly revised as the art develops. The joint efforts of the manufacturer, public utility and other groups working in harmony with the National Fire Protection Association and the American Engineering Standards Committee have resulted in the preparation and nationalization, so to speak, of the National Electrical Code. Conformity with the provisions of the code is determined by the Underwriters' Laboratories under procedure which nationalizes their test specifications and methods. The promulgation and adoption by municipalities throughout the country of a non-partisan, scientifically drawn ordinance, known as the Uniform Electrical Ordinance, completes the machinery which is effectively working on the difficult problem of eliminating the use of sub-standard material. The earnest and unselfish co-operation of the industry groups in carrying on this program for the benefit of the public is as praiseworthy as it is impressive.

In addition to uniform ordinance and code work, there must be other activities before the complete elimination of sub-standard or inferior products occurs. In each industry group there is an educational problem, the promotion of good business ethics and good business principles to show that it is to the public interest to manufacture and service quality products. Newcomers into manufacture and sales must become members of industry groups and must become convinced that their interest coincides with the public interest. Legislation to be effective must be supported by public and industry opinion. In a rapidly changing art legislation must be changed at times and must respond to changed industry and public opinion.

3. It is in the public interest that the cost of electrical installations shall be as low as consistent with safety, as determined by sound engineering practice.

The installation of electrical apparatus and supplies is regulated by the National Electrical Code, and, under procedure which has been devised and agreed upon by the major units of the electrical industry, this code is constantly kept in consonance with the most up-to-date practice. The co-operation and approval of the general public as a major interest is secured through approval by the American Engineering Standards Committee.

The indorsement of any particular type of installation and its incorporation into the National Electrical Code, which by the process already described becomes enforceable in various communities, must be based primarily upon competent engineering analysis. It must be supplemented and checked by actual experience in the field, all carried on with the co-operation of the general public, which is, of course, a major interest.

The formulation and revision of the National Electrical Code is carried on under the auspices of the National Fire Protection Association, which is a group including a wide variety of interests concerned with or directly associated with fire prevention. The membership represents federal, state and city governments, insurance and inspection groups, public utilities, electrical dealers, contractors and manufacturers and others interested. Revisions of the code are formulated by sub-committees of the electrical committee of the National Fire Protection Association. The electrical committee correlates and approves the findings of its sub-committees. These findings are then approved by the National Fire Protection Association as sponsor, and finally by the American Engineering Standards Committee. Throughout the process there is direct co-operation by all the many interested bodies, according to procedure which was prepared by a thoroughly representative body and approved and agreed upon in advance by all those participating. In this manner the public interest in the vital subject of codes is upheld by a somewhat complex but highly efficient mechanism supported by all parties concerned.

4. It is in the public interest that the installers of electric service shall be qualified, competent and receive full support and recognition.

Much of the electrical industry's service to the public is rendered directly through the electrical contractor. His workmanship is a measure of the industry's efficiency in the eyes of the general public. It is, therefore, the duty of the electrical industry to see that its contact man—the contractor—is equipped and competent to execute his all-important work to the complete satisfaction of the customer and the credit of electrical service in its various branches.

He has, speaking broadly, three definite needs, and will progress as these are gradually removed by the concerted action of all parties at interest. The first need is for better handling of jobbers' credits. Not more credit, but more discriminating credit policies are required. Under present conditions the so-called "fly-by-night" contractor constitutes a ruinous type of competition which is absolutely contrary to the public interests. Incompetence has never been condoned in the operations of the electrical industry. There is no excuse for its existence among the installers of electrical equipment.

In a number of cities local licensing or examining boards have aided in raising the standards of the contracting industry. It is highly desirable in any licensing plan that the board which establishes the competence and eligibility of the electrical contractor should be organized under the general system of representation used by the American Engineering Standards Committee. Such a board should be composed of about five members, representing the local public utility, the municipal or insurance inspection authorities, architects, city engineers and electrical contractors.

Some constructive efforts are being made in the initial inspection of electrical installations. Field needs and

experiences are quickly reflected by a large representation of electrical inspectors who guard all interests and aim at continued economy and safety as the electrical contracting profession develops. This work needs to be extended and augmented.

Assuming that the industry were thus able to clear away some of the major obstacles to efficient work by qualified contractors, there still remains the problem of education. The average electrical contractor who is earnestly striving to serve the public and also make a living is not essentially a business man. He may be a competent wireman, but he has little or no knowledge of accounting, estimating, selling and general business management. There are thousands of such men who realize at least some of their own deficiencies and are extremely anxious to acquire business training. This is not an assumption; it is well known to the few men who have conducted courses for electrical contractors in various cities throughout the country. The schools were crowded and the contractors showed the greatest interest in every phase of instruction offered.

The work done in this field is hardly more than a faltering step, but it has shown that the electrical contractor needs and desires help, and that he is deserving of it. His resources are totally inadequate to cope with the situation. The stronger groups of the industry must assume the burden of assisting him to a firmer business position if the public interest is to be served—as it must be—and universal confidence established in electrical service.

5. It is in the public interest that the business organizations of the nation should extend this co-operative self-government in their respective fields.

If a policy is adopted in a manufacturing or other individual business organization the men who are most familiar with the company's business decide how it is to be given effect. They are called upon to develop whatever procedure or technique may be required, because their familiarity with the immediate problem and with its background qualifies them to complete the transaction.

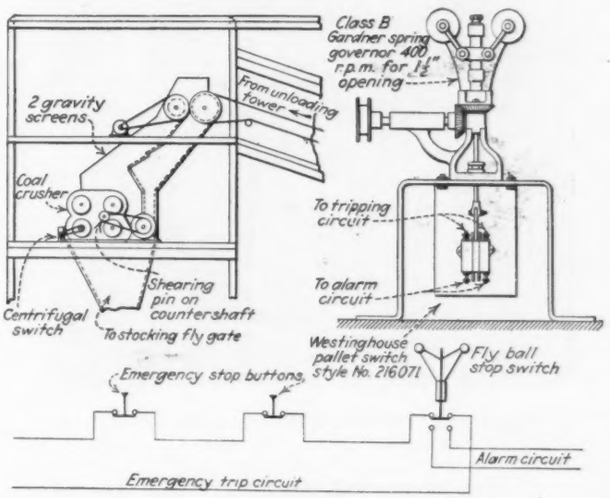
An analogous situation exists when an industry, collectively, formulates or adopts a policy. The leading executives of the industry are far better able to devise means for giving effect to the policy than any advisory or regulatory group which could be organized. Assuming the desire for unification of business policies and methods of development, the industry which has this ideal can best put it into effect by its own efforts. This is as it should be from the viewpoint of public interest, providing only that the industry in question has thoroughly convinced itself that its own interest in the final analysis coincides with that of the general public. The history of business development makes it very clear that regulation which business has found oppressive has resulted from past business operations which were considered oppressive by the public. It is only logical, therefore, to believe that as industry approximates more and more closely in its development the complete fulfillment of the public interest, an appreciative public will accord it a greater and greater measure of authority in the conduct of its own affairs. It is a primary duty of the trade associations of this country to convince every unit of their industries that upon this basis and upon this basis only permanent service and satisfactory development are assured.

Coal-Handling Equipment Protected Against Shear-Pin Failure

By F. B. McGaffic
Electrical Superintendent Stevens & Wood, Inc., Toronto, Ohio

On the system of the Ohio River Edison Company the coal is handled by a series of belt conveyors and crushers which are interlocked electrically in such a way that the belts and crushers can be started only in the proper sequence, and the stopping of any belt or crusher motor automatically shuts all the belts leading to the dead belt or crusher, thus preventing a pile up of coal at any one point due to the failure of apparatus ahead of it.

The four-roll Heyl & Patterson crushers are protected by a shearing pin in the countershaft, which stops all four rolls in case they become jammed due to tramp iron, blocks of wood and other causes. Since the interlock system is purely electrical and operated only in case of overload or accidental shut-down of one of the belt or crusher motors, it is obvious that the belts would



Flyball governor prevents pile-up on coal-handling system

continue to feed coal into the crusher after the pin is sheared, thus creating a serious jam in the hopper of the crusher and involving piling up of coal at the head of the belt conveyor.

To eliminate the above difficulty a simple centrifugal switch was developed and belted to the second roll shaft of the crusher. The switch mechanism consists of a Gardner class B spring governor head, with the stem connected to a Westinghouse pallet switch mounted on a bracket and inclosed in a sheet iron box to protect it against dirt and mechanical injury.

The emergency trip circuit that shuts down all the belt motors is connected to the top contacts of the switch, which are held in the closed position by the action of the fly-ball governor head as long as the crusher rolls are in motion.

In case of shear-pin failure, the roll stops, thus stopping the flyballs and opening the trip circuit, which in turn shuts down all the belt and crusher motors. The bottom contacts, which are closed when the governor mechanism is at rest, are connected to an alarm circuit, which lights a light and rings a bell.

Block Separators Simplify Conduit Installation

MULTIPLE-FIBER conduit placed in position and bound with cement block separators enables duct sections to be poured complete at one time in the Pennsylvania Railroad's electrical construction work at the West Philadelphia terminal. This treatment of an installation problem does away with the former practice of bridging, wiring and otherwise endeavoring to secure accurate alignment of joints. A permanent bed of cement is provided for the duct line and the spacing between ducts can be made convenient to specifications. This type of construction is adapted to long curves as well as to straight runs and the conduit is put together so strongly that workmen can walk on top of it without fear of throwing it out of alignment, which permits the trench to be narrower and reduces excavation costs. By using splashboards on the sides a saving is also made on concrete for filling in. The Brown Company, Portland, Me., furnished the multiple duct and spacers for this installation.

Multiple duct construction cuts installation costs

Economy of Sufficient and Proper Equipment on Construction Jobs

By C. E. Bland
Construction Manager
Hoosier Engineering Company, Chicago

LABOR should average about 55 to 60 per cent of the total erection cost of well-organized transmission line construction. When this ratio increases much over these figures the cause can quite often be traced to use of improper or insufficient equipment. This is an item of major importance in line construction work.

Each construction project should be studied thoroughly and equipment chosen in accordance with field conditions and type of work. It is quite evident that equipment requirements, for certain work, say in prairie country with good roads, would be radically different than the same type job in mountainous country with few roads and very poor ones at that.

For general transmission line construction it pays to have all heavy-duty trucks equipped with some sort of power-driven winch, approximately 50 per cent of these trucks being equipped with a vertical capstan and the balance with a horizontal drum winch. All heavy-duty trucks should be equipped with a trailer hitch and trucks with horizontal winches should also have skid rail fittings attached to the body for mounting pole derricks. A small investment in these items makes the equipment more adaptable to all-around work and is especially a money-saving investment when used in hauling poles and wire, or in erecting poles and conductor. It has often been noted that when a job is built with a scarcity of trucks construction crews will be found waiting for a truck to move them to another location or they will be waiting on material, whereas if an ample or even an apparent oversupply of equipment is used the loss does not occur. A crew standing idle for even a short time offsets any saving that might be made by holding idle equipment to a minimum.

Winch and capstan equipment for construction trucks

Avoiding the Stereotyped
in Transformer Installations

Investigations conducted into the effects upon substation design of oil-cooled-transformer loadings based on low ambient temperatures with and without the aid of external blowers

By F. W. GAY and J. D. WINANS

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IN A previous article, dealing with the economics of transformers in the so-called power or substation class,* there were traced the conditions leading up to and prevailing at the time of an electric operating company's recent acceptance of an engineering recommendation that future substation design be predicated on transformers of the 4,000-kva., three-phase type. Reference was made at the end of that article to the fact that consideration was at the time of its writing being given by the engineers of Public Service Production Company to the possibility of basing transformer installations on other than the customary conditions of ambient-air temperature and circulation.

In order to be in a position to secure data regarding the effects of these conditions on the power transformers purchased in the spring of 1926, the Public Service Production Company obtained from the manufacturers, before ordering, certain predetermined overload values and made certain special tests part of the acceptance conditions. From the results of these tests there was prepared Table I, showing the observed temperature conditions on 1926 transformers of three makes, first for self-cooled operation at 4,000 kva. and, second, for fan-cooled operation at 6,500 kva., and showing the maximum half-hour overload after full load at an ambient temperature of 10 deg. C., the maximum continuous load at 10 deg. C. and the maximum continuous load at 30 deg. C.

SPARE CAPACITY CONSIDERATIONS

It was the understanding at that time that the operating company was on the point of requiring one spare transformer bank in every substation of any size, installed with complete high-tension and low-tension equipment. This policy is undoubtedly the safest from the standpoint of continuity of service and the resultant public relations when no attempt is made to take advantage of other than the transformer nameplate rating, and its adoption was anticipated by the engineering and constructing company in recommending the abandonment of the standard substation of seven single-phase transformers. A hypothetical table was therefore prepared of substations having winter peak loads of from 5,000 to 32,000 kva. inclusive. This table is based on a study of the operating company's load curves, which indicate that, in a normal substation with a maximum expected load in any year of, say, 8,000 kva. in November and December, the normal winter day load will be slightly under 6,000 kva.; the normal summer load, day and evening, will also be slightly under 6,000 kva.; the normal night load, winter and summer, will be approximately 2,500 kva., and the summer peak load, obtained on occasional very dark days, will be approximately 7,000 kva.

Table II indicates clearly the point at which it is necessary to jump from one class of substation to the next: the first class consisting of two transformers with independent switching equipment; the second of four transformers in two banks, being an addition to the first stage of two transformers only; the third of five transformers in three banks, being an addition to the second stage of one transformer with its independent switching equipment, and the fourth of six transformers in three banks, being an addition to the third stage of one transformer only. For example, the maximum load of 8,000 kva. is shown as carried by two 4,000-kva. transformers, so called, believed to be capable of carrying a continuous winter load of 8,000 kva. each when equipped with fans.

TABLE I—1926 TRANSFORMER TEST DATA

Load in kilovolt-amperes	4,000			6,500		
Cooling method	Natural			Fans		
Manufacturer	X	Y	Z	X	Y	Z
Max. temperature at top of tank, deg. C.	63.5	66.0	68.5	75.3	76.0	75.5
Max. temperature at bottom of tank, deg. C.	57.3	50.6	43.5	62.9	47.0	45.5
Temperature rise of oil, deg. C.	29.8	23.6	16.0	35.4	18.5	17.5
Temperature rise of copper by resistance, deg. C.	42.4	44.6	47.25	62.2	61.2	61.0
Ambient temperature, deg. C.	27.5	27.0	27.5	27.5	28.5	28.0

Manufacturer	X	Y	Z
Maximum half-hour overload following full load at 10 deg. C., kva.	12,000	7,400	6,600
Maximum continuous load at 10 deg. C., kva.	7,000	6,400	5,900
Maximum continuous load at 30 deg. C., kva.	5,800	5,400	5,100

In this substation each transformer in normal operation will carry a winter peak load of 4,000 kva. for approximately 800 hours per year, a day load of about 2,860 kva. for approximately 4,400 hours per year and a night load of about 1,335 kva. for approximately 3,560 hours per year; the resultant load factor is 58.5 per cent. In a Class 2 substation having a maximum load of 9,000 kva., each transformer in normal operation will carry a winter peak load of only 2,225 kva. for approximately 800 hours per year, a day load of only about 1,610 kva. for approximately 4,400 hours per year and a night load of only about 750 kva. for approximately 3,560 hours per year; the resultant load factor is only 33 per cent. It is evident that as the maximum substation load increases for a Class 3 substation the load factor will improve until at a winter peak load of 16,000 kva. it will be approximately

*"4,000-Kva., Three-Phase Transformers for Jersey Substations," by F. W. Gay and J. D. Winans, ELECTRICAL WORLD, Vol. 89, No. 11, March 12, 1927, page 555.

TABLE II—SUBSTATION AND TRANSFORMER LOADS

Maximum Load, 800 Hours	Installed Capacity, Maximum Rating	Total Normal Day Load, 4,400 Hours	Total Normal Night Load, 3,560 Hours	Normal Day Load per Unit	Normal Night Load per Unit	Normal Maximum Load per Unit
CLASS 1 SUBSTATION, TWO BANKS, TWO 4,000-KVA. UNITS						
5,000	16,000	3,570	1,667	1,790	840	2,500
6,000	16,000	4,280	1,940	2,140	970	3,000
7,000	16,000	5,000	2,350	2,500	1,175	3,500
8,000	16,000	5,720	2,670	2,860	1,335	4,000
CLASS 2 SUBSTATION, TWO BANKS, FOUR 4,000-KVA. UNITS						
9,000	32,000	6,430	3,000	1,610	750	2,225
10,000	32,000	7,140	3,340	1,790	835	2,400
11,000	32,000	7,850	3,680	1,970	920	2,750
12,000	32,000	8,460	4,000	2,120	1,000	3,000
13,000	32,000	9,300	4,340	2,330	1,085	3,250
14,000	32,000	10,000	4,670	2,500	1,168	3,500
15,000	32,000	10,700	5,000	2,680	1,250	3,750
16,000	32,000	11,420	5,340	2,880	1,335	4,000
CLASS 3 SUBSTATION, THREE BANKS, FIVE 4,000-KVA. UNITS						
17,000	40,000	12,200	5,670	2,440	1,890*	3,400
18,000	40,000	12,850	6,000	2,570	2,000*	3,600
19,000	40,000	13,550	6,340	2,710	2,110*	3,800
20,000	40,000	14,300	6,670	2,860	2,230*	4,000
21,000	40,000	15,000	7,000	3,000	2,340*	4,200
22,000	40,000	15,720	7,320	3,140	2,440*	4,400
23,000	40,000	16,420	7,670	3,290	2,560*	4,600
24,000	40,000	17,150	8,000	3,440	2,670*	4,800
CLASS 4 SUBSTATION, THREE BANKS, SIX 4,000-KVA. UNITS						
25,000	48,000	17,860	8,330	2,980	2,080*	4,167
26,000	48,000	18,550	8,660	3,100	2,170*	4,334
27,000	48,000	19,280	9,000	3,200	2,250*	4,500
28,000	48,000	20,000	9,340	3,330	2,330*	4,667
29,000	48,000	20,770	9,670	3,460	2,410*	4,834
30,000	48,000	21,410	10,000	3,580	2,500*	5,000
31,000	48,000	22,170	10,330	3,700	2,590*	5,167
32,000	48,000	22,850	10,660	3,820	2,670*	5,334

*One bank, two units, out of service.

the same as for the Class 1 substation having a maximum load of 8,000 kva.

The foregoing discussion is based on the hypothesis that transformers can be purchased capable of delivering 8,000 kva. in winter and 7,000 kva. in summer, designed to have maximum efficiency at a load of approximately 66 per cent of the rated 4,000 kva. The present method of evaluating losses results in obtaining for the system in question a transformer with maximum efficiency at about this point.

TEMPERATURE SPECIFICATIONS ON TRANSFORMERS

As a result of these studies it was decided in December, 1926, to incorporate in the specifications covering three-phase power transformers requirements to the effect that each transformer should be capable of carrying 100 per cent load continuously, when unaided by blowers, with an ambient temperature of 40 deg. C. and with a measured temperature rise not exceeding 55 deg. C., an additional 10 deg. C. being allowed for the hot-spot. Besides, each transformer should be capable of carrying 150 per cent load continuously, when unaided by blowers, with an ambient temperature of 10 deg. C. and with a measured temperature rise not exceeding 80 deg. C., an additional 15 deg. C. being allowed for the hot-spot. Practically all 4,000-kva. transformers purchased up to that time for this operating company are in a position to carry 150 per cent load continuously in the winter without blowers.

In addition, it was decided at the same time to incorporate in the specifications covering three-phase power transformers requirements to the effect that each manufacturer should give in his quotation a warranted value for the percentage load which each transformer would be capable of carrying continuously when aided by blowers, with an ambient temperaure of 30 deg. C. and with a temperature rise not exceeding 63 deg. C., an additional 12 deg. C. being allowed for the hot-spot. Besides, each manufacturer should give in his quotation a warranted value for the percentage load which each transformer would be capable of carrying continuously, when aided by blowers, with an ambient temperature of 10 deg. C. and with a temperature rise not exceeding 80 deg. C., an additional 15 deg. C. being allowed for the hot-spot. The ability of the transformers of this type which have since been purchased to carry overloads has been therefore definitely known in advance, and it is possible to install blowers at any time to increase capacity without having affected transformer design or cost by specifying definite operating characteristics with forced-air circulation.

FANS CAN BE USED TO INCREASE BANK CAPACITY

It is the consensus of opinion among the engineers that the capacity of a two-bank, two-unit substation with one bank out of service can be expanded by the use of fans to approximately 8,000 kva. in winter and to approximately 7,000 kva. in summer. Fans are, therefore, of possible use only in two-unit (two-bank) substations where the winter load lies between 6,000 and 8,000 kva., and in four-unit (two-bank) substations where the winter load lies between 12,000 and 16,000 kva.

It appears advantageous to use forced-air circulation in substations of the former class, since it would otherwise be necessary to increase the substation investment by approximately $25,000 at least two years in advance of the time when this becomes necessary even with fans, or, capitalized at 17 per cent per year, to increase the cost of substation operation $8,500 for the two-year period, and since the additional installation would increase the substation losses approximately 132 megawatt-hours per year, or, valued at $7.50 each, increase the cost of substation operation $1,960 for the two-year period, whereas the cost of purchasing, installing and withdrawing four 24-in. disk fans of the outdoor type would be comparatively negligible.

It appears disadvantageous to use forced-air circulation in substations of the latter class, since the substation is at this stage in its development of increased importance to the system and the addition of an extra one-unit bank would decrease the substation losses approximately 85 megawatt-hours per year.

However, discussion with a representative of one of the transformer manufacturers in regard to the proposed specification for 4,000-kva. power transformers showed it advisable to give the manufacturers additional information in regard to the overload capacities which it was desired to establish. It is at once apparent that whereas it is customary to base ratings on an ambient temperature of 40 deg. C., in most sections of the country the temperature seldom exceeds 30 deg. C. and never at times of peak load on the substations under discussion. The manufacturers naturally take cognizance of this fact, knowing that their transformers therefore operate with a maximum hot-spot temperature of 90 to 95 deg. C. It would not be evident to the manufacturers, on the other hand, that any mention which might be made of a lower am-

TABLE III—1927 TRANSFORMER OVERLOAD CAPACITIES

Based on Hot-Spot Total Temperature of 105 Deg. C.

Cooling method	Natural		Fans	
Ambient temperature, deg. C	30	10	30	10
Manufacturer A	5,100	6,000	6,600	7,500
Manufacturer B	5,500	6,500	7,600	8,500
Manufacturer C	6,000	7,200	8,000	9,400

bient temperature, 10 deg. C. for example, would also involve a factor of safety. This possibility of misunderstanding it is desirable to avoid, since the designers would be fearful, at least, of excessive sludging if they actually permitted operation at the maximum permissible temperature without giving the oil an opportunity to "recuperate." It therefore became necessary to request information by means of the specification as to overload capacities with blowers at ambient temperatures of 10 deg. C. and 30 deg. C., respectively, as outlined in the foregoing paragraph, except that these overloads were required to be carried for a period of not more than ten successive hours per day for not more than seven successive days per year, instead of for an indefinite period. It is believed that this load cycle is more severe than the worst condition that can be encountered in actual service. It also seemed advisable to obtain the same information in regard to the operation of the transformers without blower equipment.

The values which the manufacturers were able to warrant and the slightly higher values usually shown by the test reports have justified expectations. This situation is clearly indicated by the test results on 1927 transformers of three makes, as given in Table III.

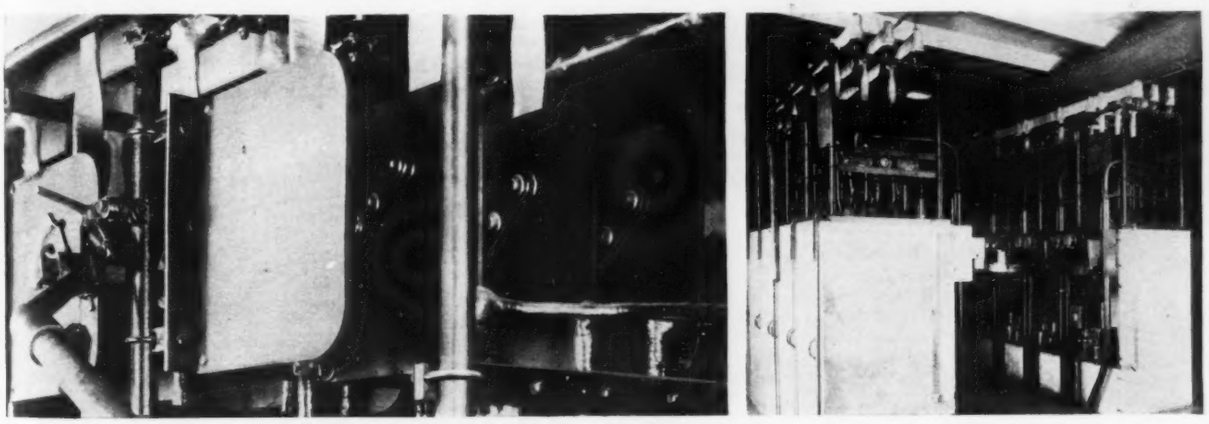
Blower Equipment Specified for Large Transformers

It is to be noted that in the case of 4,000-kva. transformers the question of forced-air circulation has been considered only from the standpoint of fans, such being the case due to the fact that blower installations, if decided upon, are to be of a temporary nature and no justification can therefore be found for equipping each transformer with individual permanent ducts and nozzles. In the case, however, of some larger transformers, it has been found advisable to request information as to the continuous capacity and temperature rise: (1) Based upon an ambient temperature of 40 deg. C. and upon the manufacturer's standard artificial means of air circulation; (2) based upon an ambient temperature of 30 deg. C. and upon the manufacturer's standard artificial means of air circulation, and (3) based upon an ambient temperature of 30 deg. C. and upon no artificial means of air circulation. These requirements are incorporated in the general specification in question; the detail specification accompanying this general specification stating that the manufacturer should equip each transformer at the factory with standard blowing equipment, including necessary piping and provision for later installation of individual blower and motor.

Economy of Factory-Assembled Disconnecting Switches

By George F. Heidenreich
Columbia Engineering & Management Corporation, Cincinnati, Ohio

Remote gang operations of disconnecting switches is becoming virtually a necessity in modern station and substation practice. The advantages of this method of operation are very apparent, namely, ease, safety and speed of operation; elimination of possible single-phase switching through error; economy of space required for installation and operation; saving in installation cost due to use of switches completely assembled and adjusted at the factory. In earlier installations of remote gang-operated switches, where the unit assemblies had to be built up, adjusted and aligned in the field, the cost of the installation became such that the advantages of this type of operation were offset by the additional field cost. This difficulty has now been largely eliminated through the practice of using some of the many types of gang-operated disconnecting switches now offered by the manufacturers, completely assembled and adjusted before shipment.



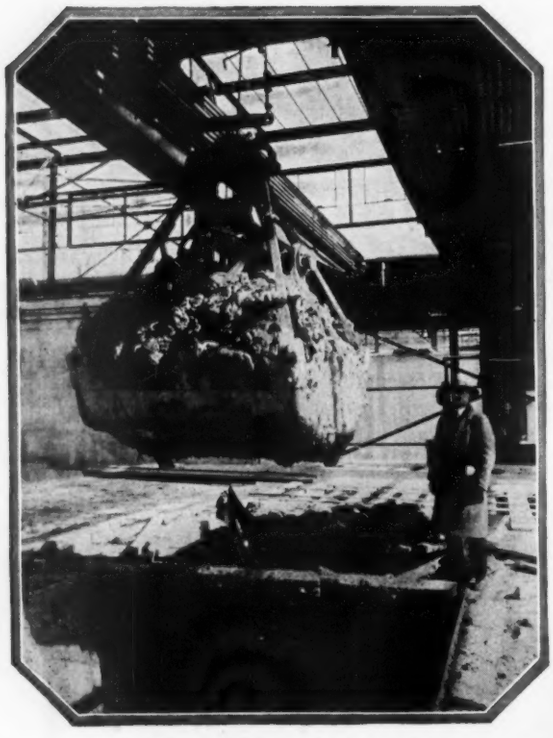
Very small space was required for these gang-operated 2,300-volt disconnects

A conspicuously good example of the economies of such practice is found at the Columbia power station of the Union Gas & Electric Company at Cincinnati, Ohio. In this station all circuit and bus ties of the 2,300-volt, three-phase station service bus are equipped with remote gang-operated disconnecting switches. The initial installation comprised 90 of these switches of 600, four of 1,200 and four of 2,000-amp. capacity, furnished by the Electrical Engineers Equipment Company. The ease and speed with which these switches were installed greatly facilitated the meeting of an extremely rapid construction schedule. In this particular installation the saving in time and labor effected by the use of the assembled switch instead of the earlier types can conservatively be estimated at 25 per cent of the total cost of the disconnecting switch installation. In addition to the above, twelve more of the 600-amp. switches of the same type and manufacture have recently been installed.

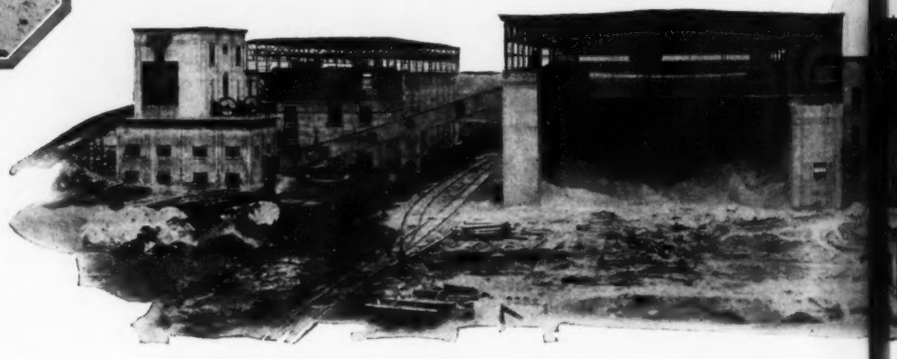
New England's Pioneer Cement P

Features of motor drives in Lawrence Portland Cement plant designed for 3,000 bbl. a day. Provisions for reliable service and nature of purchased power contract

A PLANT costing $4,000,000 which is capable of producing about 1,000,000 barrels of cement per year was recently placed in operation at Thomaston, Me., by the Lawrence Portland Cement Company. This is the only mill of the kind in New England and the extent and completeness of its electrical equipment have attracted many engineering visitors. The plant is operated by energy supplied by the Central Maine Power Company on a contract which brings the cost of electricity to about 8 mills per kilowatt-hour. The connected load is about 7,000 hp. and power is supplied over a 33-kv. single-circuit line 5.75 miles long from the Rockland switching station to the mill. From Rockland a double-circuit line has been built through Maxcy's substation near Augusta to the Gulf Island hydro-electric plant of the Central Maine company to minimize the complete outage of transmitted service.



Clay-storage crane with 3-cu.yd. bucket. It is equipped with one 75-hp. bridge motor, one 15-hp. trolley motor and two 75-hp. hoist motors



150-hp. electric shovel in rock quarry

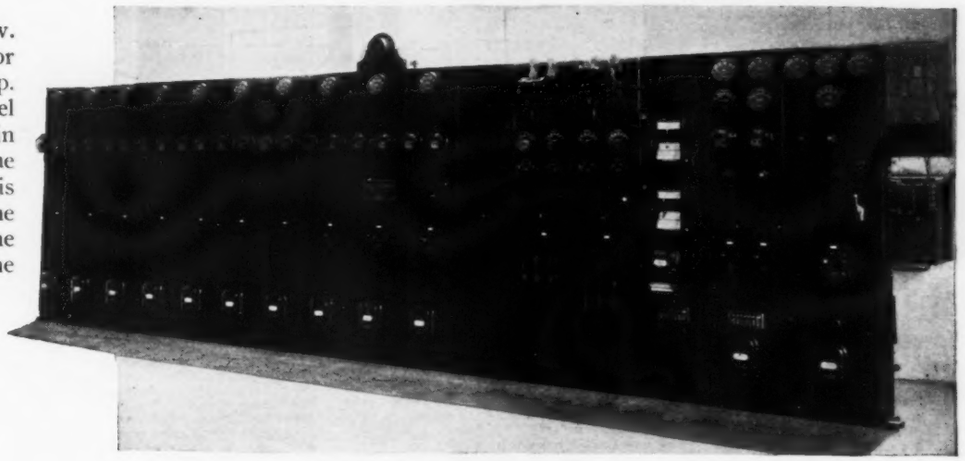
To insure continuous service in case of interruption of the supply of transmitted energy to kilns, coolers and agitators in the clay storage and main slurry

Plant Uses 15 Kw.-Hr. per Barrel

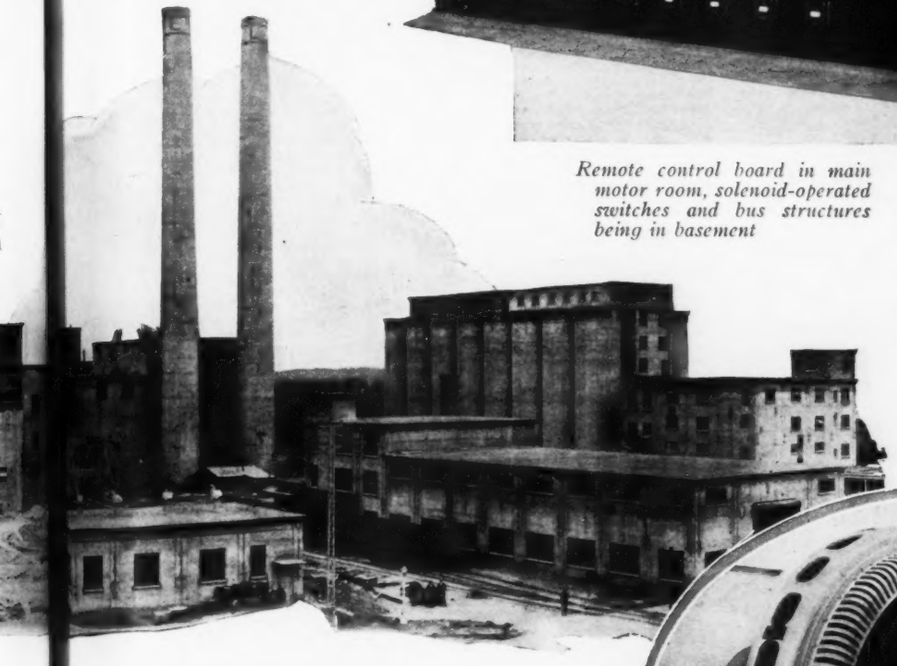
storage basins, a 240-kw. Allis-Chalmers generator direct-driven by a 360-hp. Fairbanks-Morse Diesel engine has been installed in the main motor room. The main switch of this unit is interlocked with that of the incoming line so that the two cannot be closed at the same time. Paralleling of the auxiliary unit with the incoming supply is unnecessary.

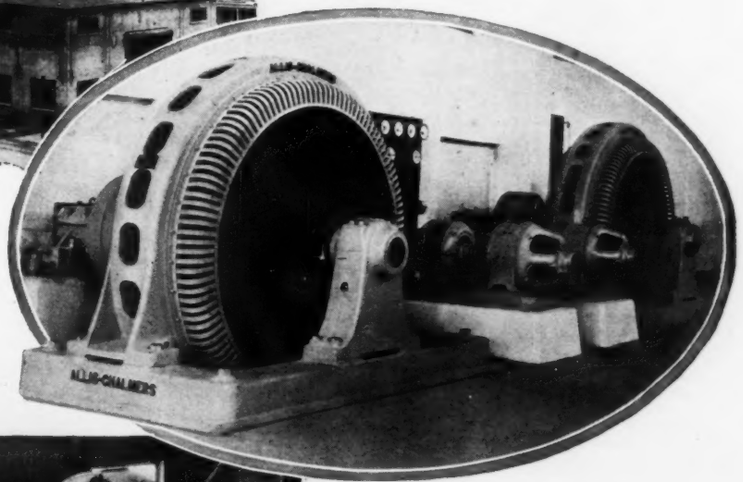
About 15 kw.-hr. per barrel is consumed by this establishment, in which are 265 motors, including about 35 spares. In general, motors above 50 hp. are wound for 2,200 volts and those under this rating for 440 volts. The sizes range from 800 hp. to fractionals.

The plant has a capacity of 3,000 bbl. per day and provision has been made in the design to double this by the addition of kilns. There are fourteen buildings and a 7,500-kva. industrial



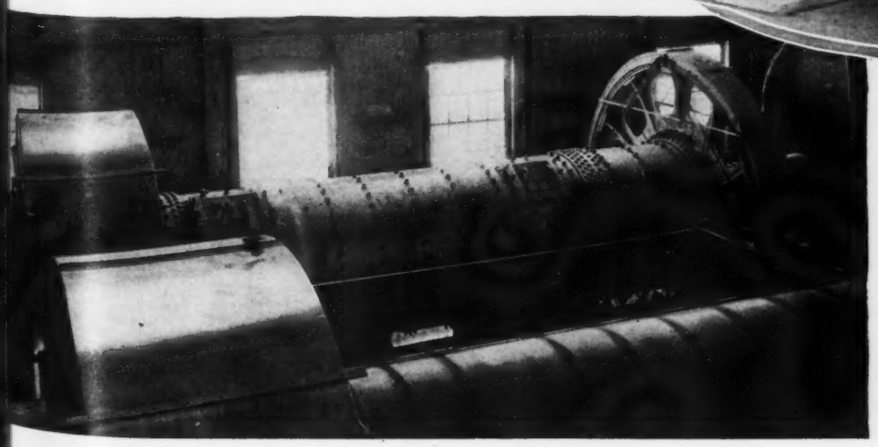
Remote control board in main motor room, solenoid-operated switches and bus structures being in basement





Compeb mill motors in main motor room

Each is an Allis-Chalmers "Hy-Tork" type, with five slip rings. These start as slip-ring motors with resistance in the rotor circuit. When nearly up to speed direct current at about 45 volts is introduced into the rotor, giving it definite magnetic poles and pulling it into synchronism. Subsequently it operates as a synchronous motor at about 100 per cent power factor.



Compeb mill gear-driven by an 800-hp. motor

Portion of another compeb mill which is in operation appears in foreground

Nature of Some Motor Drives in Thomaston Plant of Lawrence Portland Cement Company

With the exceptions marked all motors in the plant rated at more than 50 hp. operate at 2,200 volts and all others at 440 volts.

*Full load.
[1]440-volt.
[2]2,200-volt.
[3]220-volt.
[4]125-volt d.c.
[5]110-volt single-phase.
[6]110-volt three-phase.

Driven Load	HP.	R.P.M.	Type	Drive
LIME PLANT				
Quarry hoist[1]	80	900	Slip ring	Gear
Pump	30	1160	Squirrel cage	Direct
Pump	2	1740	Squirrel cage	Direct
Coal conveyor	2	1150	Squirrel cage	Direct
Oil pump	7½	860	Squirrel cage	Belt
Barrel elevator	3	1750	Squirrel cage	Direct
Coal crusher	15	1155	Squirrel cage	Belt
Conveyor	10	1155	Squirrel cage	Belt
Pit pump	¾	1745	Squirrel cage	Direct
Lime plant ground lime plant	2	1155	Squirrel cage	Belt
	50	1150	Slip ring	Belt
	7½	860	Squirrel cage	Gear
	7½	860	Squirrel cage	Belt
	7½	860	Squirrel cage	Belt
	7½	860	Squirrel cage	Gear
	7½	860	Squirrel cage	Gear
Frequency changer set	1	1155	Squirrel cage	Gear
	3	860	Squirrel cage	Direct
CEMENT PLANT				
Driven Load	HP.	R.P.M.	Type	Drive
Cement quarry water pump	20	....	Squirrel cage	Direct
No. 1 slurry mill	800	180	Synchronous	Direct geared mill
No. 2 slurry mill	800	180	Synchronous	Direct geared mill
No. 1 finish mill	800	180	Synchronous	Direct geared mill
No. 2 finish mill	800	180	Synchronous	Direct geared mill
No. 1 slurry mill exciter	34	....	Squirrel cage	Direct
No. 2 slurry mill exciter	34	....	Squirrel cage	Direct
No. 1 finish mill exciter	34	....	Squirrel cage	Direct
No. 2 finish mill exciter	34	....	Squirrel cage	Direct
No. 1 motor-gen. set	60	1200	Synchronous	Direct
No. 2 motor-gen. set	60	1200	Synchronous	Direct
No. 1 air compressor	300	225	Synchronous	Direct
No. 2 air compressor	300	225	Synchronous	Direct
Battery charger[3]	3½	....	Squirrel cage	Direct
Diesel oil pump	1	1800	Squirrel cage	Gear
Slurry trough agitator	5	*850	Squirrel cage	Dir. to reduc. gear
No. 1 Pump from mill	40	*1155	Squirrel cage	Direct
No. 2 pump from mill	40	*1155	Squirrel cage	Direct
Screw after compeb	5	*850	Squirrel cage	Dir. to reduc. gear
Clinker dust blower	40	*1155	Squirrel cage	Direct
Clinker dust screw	5	*1140	Squirrel cage	Dir. to reduc. gear
Clinker dust bag rapper	1	*1130	Squirrel cage	Direct
No. 1 cement pump	125	*870	Squirrel cage	Direct
No. 2 cement pump	125	*870	Squirrel cage	Direct
No. 1 clay pump to compeb	15	*730	Squirrel cage	Direct
No. 2 clay pump to compeb	15	*730	Squirrel cage	Direct
No. 1 clay feeder[4]	1	400/1200	Shunt	Dir. to reduc. gear
No. 2 clay feeder[4]	1	400/1200	Shunt	Dir. to reduc. gear
Clay basin agitator	5	850	Squirrel cage	Dir. to reduc. gear
Clinker poidometer	3	1140	Squirrel cage	Dir. to reduc. gear
Gypsum poidometer	3	1140	Squirrel cage	Dir. to reduc. gear
Fresh clinker drag conveyor	15	860	Squirrel cage	Dir. to reduc. gear
Fresh clinker elevator	15	860	Squirrel cage	Dir. to reduc. gear
Mixed clinker elevator	15	860	Squirrel cage	Dir. to reduc. gear
Mixed clinker drag conveyor	15	860	Squirrel cage	Dir. to reduc. gear
Raw Storage dust fan	10	1730	Squirrel cage	Direct
Raw storage dust bag shaker	1	1130	Squirrel cage	Direct
Quarry car hoist	250	585	Slip ring	Dir. to gear. hoist
No. 1 quarry hoist oil pump	1	1730	Squirrel cage	Direct
No. 2 quarry hoist oil pump	1	1730	Squirrel cage	Direct
Crushing				
Gyrating rock crusher	200	585	Slip ring	Belt
Rock crusher pan conveyor	15	860	Squirrel cage	Dir. to reduc. gear
Refining hammer mill	300	705	Slip ring	Direct
Crushed rock conveyor	25	855	Squirrel cage	Dir. to reduc. gear
Crushed rock dist'g belt	15	860	Squirrel cage	Dir. to reduc. gear
No. 1 Sheppard car dump	14	1100	Slip ring	Gear
No. 2 Sheppard car dump	14	1100	Slip ring	Gear
Crusher dust blower	40	1155	Squirrel cage	Direct
Crusher dust screw	5	1140	Squirrel cage	Dir. to reduc. gear
Crusher dust bag shaker	1	1130	Squirrel cage	Direct
Clay "pug" mill[1]	75	865	Squirrel cage	Flexible rope
Clay "wash" mill	75	695	Slip ring	Belt
No. 1 clay pump	30	1155	Slip ring	Direct
No. 2 clay pump	30	1155	Slip ring	Direct
Gypsum apron feeder	5	850	Slip ring	Dir. to reduc. gear
Gypsum crusher[1]	100	865	Slip ring	Direct
Gypsum elevator	15	860	Slip ring	Dir. to reduc. gear
Coal Handling				
Coal conveyor to crusher	5	850	Slip ring	Dir. to reduc. gear
Coal crusher	30	865	Slip ring	Direct
Wet coal elevator	10	860	Slip ring	Dir. to reduc. gear
Wet coal poidometer	3	1140	Slip ring	Gear
Coal dryer	40	690	Slip ring	Dir. to reduc. gear
Coal dryer exhauster	7½	680	Slip ring	Direct
Dry coal elevator	10	860	Slip ring	Direct to red. gear
No. 1 Raymond mill[1]	75	430	Slip ring	Direct
No. 1 Raymond mill exhaust	40	1155	Slip ring	Direct
No. 2 Raymond mill[1]	75	430	Slip ring	Direct
No. 2 Raymond mill exhaust	40	1155	Slip ring	Direct
Coal dryer fuel blower	5	3500	Slip ring	Direct
Coal dryer Bailey feeder[4]	1	400/1200	Slip ring	Sprocket & chain
Coal mill dust blower	20	1150	Slip ring	Direct
Coal mill dust screw	5	1140	Slip ring	Dir. to reduc. gear
Coal mill bag shaker	1	1130	Slip ring	Direct
Coal dryer dust blower	15	1150	Slip ring	Direct
Coal dryer dust screw	5	1140	Slip ring	Dir. to reduc. gear
Coal dryer bag shaker	1	1130	Slip ring	Direct
Coal mill main screw	5	854	Slip ring	Dir. to reduc. gear
Kilns				
No. 1 kiln	75	870	Slip ring	Dir. to geared dr.
No. 1 cooler	40	860	Squirrel cage	Dir. to geared dr.
No. 1 kiln blower	40	1155	Squirrel cage	Direct
No. 1 kiln coal feeder	2	500/1500	Shunt	Sprocket & chain
No. 2 kiln	75	870	Slip ring	Dir. to geared dr.
No. 2 cooler	40	860	Squirrel cage	Dir. to geared dr.
No. 2 kiln blower	40	1155	Squirrel cage	Direct
No. 2 kiln coal feeder[4]	2	500/1500	Shunt	Sprocket & chain
No. 1 slurry pump to kiln	40	1155	Squirrel cage	Direct
No. 2 slurry pump to kiln	40	1155	Squirrel cage	Direct
Kiln basin agitator	10	860	Squirrel cage	Gear
Long dust screw from stack	5	850	Squirrel cage	Direct to red. gear
Short dust screw from stack	5	850	Squirrel cage	Direct to red. gear
Dust pump to receiver	15	860	Squirrel cage	Direct
Slurry				
No. 1 slurry correction pump	40	1155	Squirrel cage	Direct
No. 2 slurry correction pump	40	1155	Squirrel cage	Direct
No. 3 slurry correction pump	40	1155	Squirrel cage	Direct
No. 1 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 2 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 3 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 4 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 5 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 6 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 7 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 8 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 9 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 10 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 11 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 12 correction tank agitator	25	572	Squirrel cage	Dir. to geared dr.
No. 1 pack house main screw	50	860	Slip ring	Direct to red. gear
No. 2 pack house main screw	50	860	Slip ring	Direct to red. gear
No. 3 pac'k house main screw	50	860	Slip ring	Direct to red. gear
No. 1 pack house cross screw	5	850	Squirrel cage	Direct to red. gear
No. 2 pack house cross screw	5	850	Squirrel cage	Direct to red. gear
No. 1 bucket elevator	15	860	Squirrel cage	Direct to red. gear
No. 2 bucket elevator	15	860	Squirrel cage	Direct to red. gear
No. 1 pack house cement blower	15	1150	Squirrel cage	Drive direct
No. 1 pack house cement blower	15	1150	Squirrel cage	Drive direct
Bag wheel blower	20	1150	Squirrel cage	Drive direct
Pack house dust screw	5	1160	Squirrel cage	Direct to red. gear
No. 1 Bates packer	20	1150	Squirrel cage	Direct
No. 2 Bates packer	20	1150	Squirrel cage	Direct
No. 3 Bates packer	20	1150	Squirrel cage	Direct
No. 4 Bates packer	20	1150	Squirrel cage	Direct
No. 1 packer belt	5	850	Squirrel cage	Direct to red. gear
No. 2 packer belt	5	850	Squirrel cage	Direct to red. gear
Bag tie machine	2	850	Squirrel cage	Belt
Bag wheel drive	25	865	Squirrel cage	Direct to red. gear
Freight elevator	10	720	Squirrel cage	Direct
No. 1 heater drive	¼	860	Squirrel cage	Direct
No. 3 heater drive	¼	860	Squirrel cage	Direct
No. 2 heater drive	¼	860	Squirrel cage	Direct
No. 4 heater drive	¼	860	Squirrel cage	Direct
No. 1 dust shaker	....	....	.....	Direct
No. 2 dust shaker	....	....	.....	Direct
No. 3 dust shaker	....	....	.....	Direct
Machine Shop				
Power hacksaw	½	850	Squirrel cage	Direct
Pipe threader	5	1150	Squirrel cage	Direct
Store house freight elevator	7½	720	Squirrel cage	Direct
36 in. lathe	25	1160	Squirrel cage	Gear
Wet grinder	½	1740	Squirrel cage	Gear
Shaper	10	1750	Squirrel cage	Gear
12-in. lathe	3	1160	Squirrel cage	Gear
Crane (mach. shop)	20	840	Slip ring	Gear
Emery wheel	3	1750	Squirrel cage	Gear
Tool grinder	2	1740	Squirrel cage	Gear
18-in. lathe	5	1750	Squirrel cage	Gear
Cold cut saw	7½	870	Squirrel cage	Gear
Blacksmith forge[5]	½	1720	Single phase	Direct
Boring mill	7½	1170/880/58	Sq. c.	Gear
Drill grinder	1	1710	Squirrel cage	Gear
Drill press	1	1750	Squirrel cage	Gear
Radial drill	7½	1740	Squirrel cage	Gear
Electric welder	10	1750	Squirrel cage	Direct
Trip hammer	10	860	Squirrel cage	Belt
Punch and shear	5	1750	Squirrel cage	Gear
Bolt threading mach.	3	1160	Squirrel cage	Gear
Milling machine	15	1740	Squirrel cage	Gear
Planer	10	1160	.....	Gear
Miscellaneous				
No. 1 mach. shop heater	¼	860	Squirrel cage	Direct
No. 2 mach. shop heater	¼	860	Squirrel cage	Direct
No. 3 mach. shop heater	¼	860	Squirrel cage	Direct
No. 4 mach. shop heater	¼	860	Squirrel cage	Direct
No. 1 oil pump	3	1730	Squirrel cage	Direct
No. 2 oil pump	3	1730	Squirrel cage	Direct
No. 1 heater nozzle	¾	3450	Squirrel cage	Direct
No. 2 heater nozzle	¾	3450	Squirrel cage	Direct
Oil pump from tank	½	3450	Squirrel cage	Direct
Oil pump from tank	½	3450	Squirrel cage	Direct
Office pressure testing mach.[5]	2	1750	Single phase	Belt
Crusher and grinder[6]	2	850	Squirrel cage	Belt
Raw Storage Crane				
Holding line[1]	75	690	Slip ring	Gear
Closing line[1]	75	690	Slip ring	Gear
Bridge[1]	75	690	Slip ring	Gear
Carriage	15	860	Slip ring	Gear
Clay Storage Crane				
Holding line[1]	75	690	Slip ring	Gear
Closing line[1]	75	690	Slip ring	Gear
Bridge[1]	75	690	Slip ring	Gear
Carriage	15	860	Slip ring	Gear
No. 1 coal mill man hole pump	1	1140	Squirrel cage	Vert. direct
No. 2 coal mill man hole pump	1	1140	Squirrel cage	Vert. direct
Drill pointer	5	860	Squirrel cage	Belt
Snap line in quarry	30	850	Slip ring	Gear
No. 1 kiln dust collector	7½	1155	Squirrel cage	Direct
No. 2 kiln dust collector	7½	1155	Squirrel cage	Direct
Aux. clinker drag	10	1150	Squirrel cage	Direct to red. gear
Mill bldg. crane	20	840	Slip ring	Gear

substation on the property. Among the major features of the plant are an office building, machine shop and storehouse crusher building, kiln building, coal mill, raw storage bins, mill and motor buildings.

The kiln building contains two kilns, each 200 ft. long x 11 ft. in diameter. Beneath each of these is a cooler 90 ft. long, 9 ft. in diameter. Near the kiln building are twelve slurry tanks installed in two rows of six each; these tanks are 12 ft. in diameter by 20 ft. deep. The coal mill is equipped with pulverizers and a rotary drier having a capacity of 13 tons.

Two wet and two dry compeb mills are installed, each 40 ft. long and direct-connected to an 800-hp. motor. These are reported to be the largest wet and dry mills in the country and each weighs 240,000 lb.

The crusher building which is near the edge of the quarry is served by two inclined industrial railroad approaches

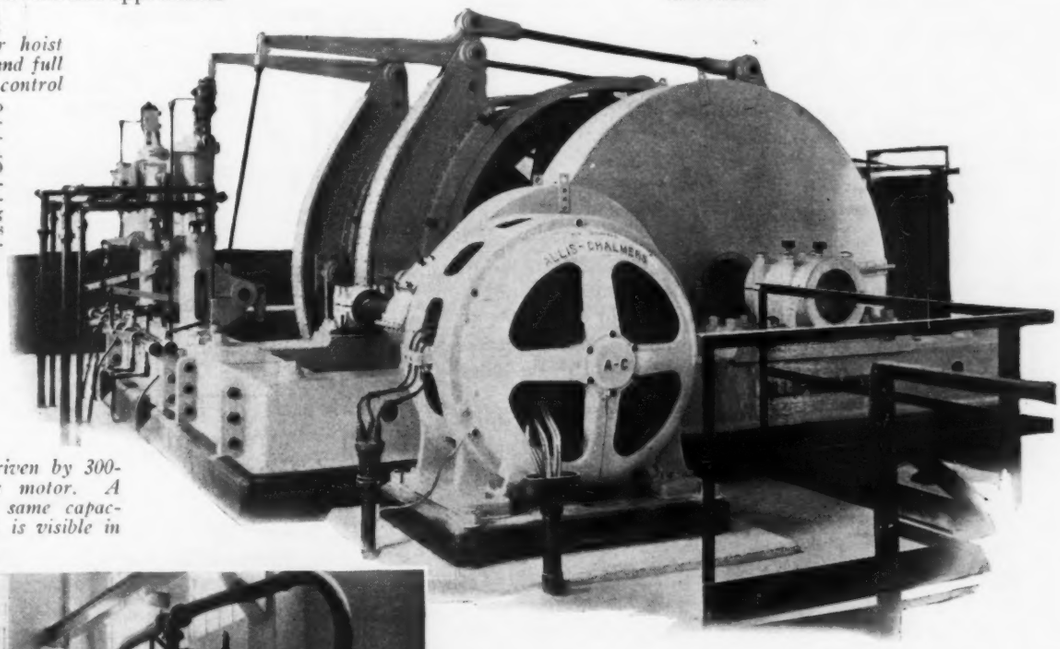
Gyratory rock crusher and secondary hammer mill motor drives. The crusher is belt driven by a 200-hp. motor and the hammer mill is operated by a 300-hp. unit

of 30 deg. Loaded cars of rock weigh about 20 tons. The crusher turns out 250 tons of rock per hour.

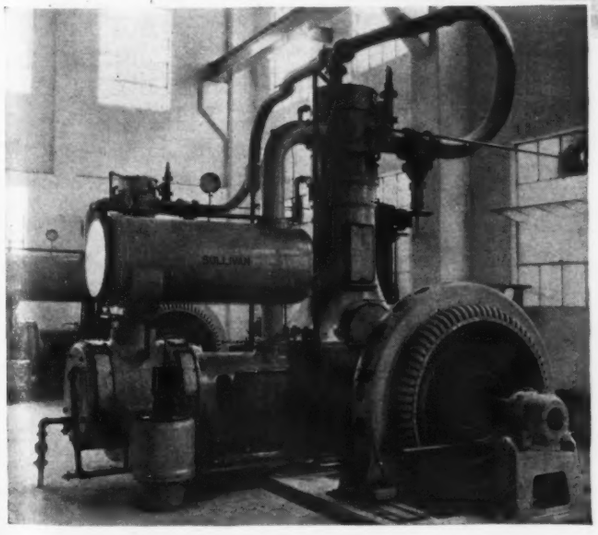
With the exception of the gyratory crusher and clay preparation machines there are no belt drives in the plant. All other slow-motion equipment, such as elevators and conveyors, is chain-driven from worm-gear speed reducers made by the Philadelphia Gear Works. There are about 35 of these, ranging in size from 1 to 50 hp. All have outboard bearings and are connected through Falk-Bibby flexible couplings to individual motors mounted on common baseplates. With one or two exceptions all motors were supplied by the Allis - Chalmers company and are fitted with Timken roller bearings. Direct current at 125 volts for various uses is supplied through two 50-kw. synchronous motor - generator sets, one being held in reserve. A table of motor drives is published herewith.

250-hp. quarry car hoist with 9-ft. drum and full magnetic remote control

The hoist has two complete and independent oil-operated brakes. A saving of 30 per cent in hoisting energy is obtained by using two incline tracks with cars in balance.



Air compressor driven by 300-hp. synchronous motor. A reserve unit of same capacity (1,800 cu.ft.) is visible in background



Energy is supplied by the Central Maine company to industrial customers having a demand in excess of 2,000 hp. and requiring electricity for continuous operation during each hour of the month with the exception of November to February inclusive at a rate of 8 mills and a minimum charge as follows:

The demand is the greatest average amount of power used for any 30-minute period during the month. For any month except during November-February inclusive, the minimum charge is calculated by taking the demand of the customer (at not less than 3,000 kw. here) times the total number of hours in the month and by multiplying the product by 0.7.

The agreement provides for shutting down a portion of the plant during midwinter.

Importance of Flexibility in High-Tension Bus

By A. B. Dibner
Design Engineer Burndy Engineering Company, Inc., New York City

CAUSES of insulator breakage in a high-tension substation structure can usually be traced down to one of four sources: Unequalized expansion of the copper bus and of the steel upon which it is carried; shock, due to oil circuit breaker operation; the stresses of storm and high winds, and those due to settling of foundations.

For temperate climates, an annual temperature change of 100 deg. F. is most common. For inland locations this variation in temperature may exceed 120 deg. F. Temperature change and the length of bus, as factors, may produce a total change in length of a number of inches, which change must be absorbed, either in a flexible steel supporting system, expansion joints placed at intervals in the rigid bus, or a means of sliding provided, upon which the expanding bus may ride. Where the copper tube bus is long and the diameter of tube is correspondingly large, it is not to be expected to depend on the steel (expanding at three-quarters the rate of copper) to absorb such changes in length. Where the copper bus connects pieces of stationary equipment close to the ground, no such compensating expansion exists at all and must be provided for in other ways.

Expansion joints are usually advisable in that their presence is evident and discounted as a source of other trouble. Their operation is direct and full. Their design usually allows for the absorption of expansion greater than predetermined, which is recommended for a system exposed to so many variations as above mentioned. The practice of fastening a run of bus at its middle and permitting the expanding ends to slide in loose bus supports is very economical, but not quite as dependable as expansion joints, for the reason that creeping may set in. The bus supports should be so designed and manufactured as to make it impossible for the bus support to be clamped tight about the tube bus. Shims between the halves of the bus supports or blocks of metal cast within the bus support proper make this possible.

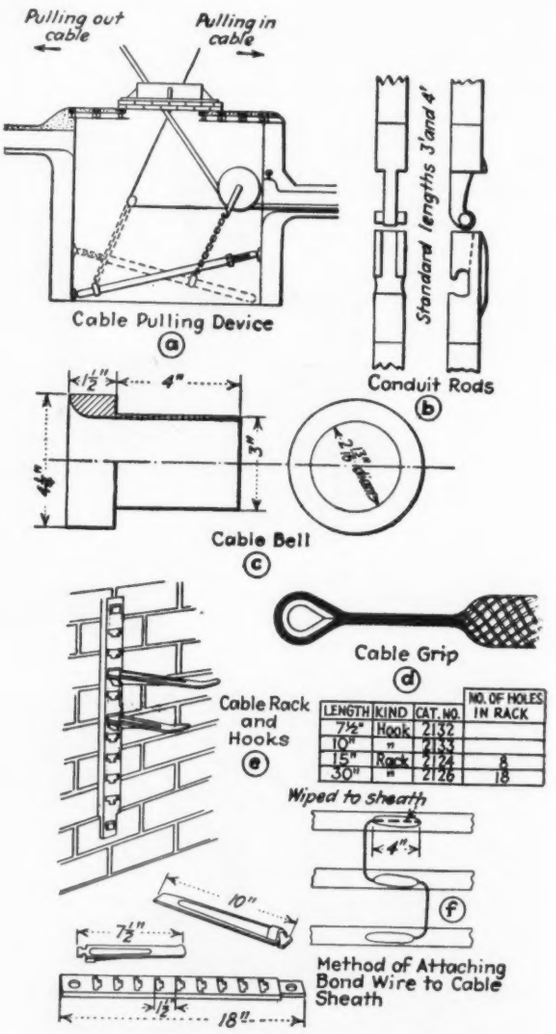
Where the heavy copper tube bus connects solidly to an oil circuit breaker there is the inherent possibility that breaker operation may jar the bus system to the extent of breaking supporting insulators, sensitive to shock. This can be avoided by expansion studs. These studs can be designed so as to avoid not only transposition of the shock to the bus, but also any settling of the breaker foundation that may take place. Substation locations are selected very often on hillsides or places of great slope, with which hydro-electric sites are usually associated. This requires "cut and fill," so that half the substation may be filled-in ground. Such filled-in foundation, when carefully constructed of stone, will not settle, but where such settling, due to improper filling, does take place, it will impose strains on the insulators that may result in damage. A loose coupling between this equipment and the bus, through expansion studs or flexible cables, will prevent damage. In one instance a 2-in. settlement was noted within a period of eight months after installation.

Because of the comparatively small area exposed to wind pressure, it is not a serious factor. However, in storm centers or where heavy snow falls or sleet deposits coupled with heavy winds are to be expected, it is advisable not to make the bus system too rigid, to avoid insulator strain. The means suggested will do as well for strains imposed by weather as in other cases.

On long lengths of bus, changes in direction will do much to overcome any danger of expanding copper. This, however, may not be easily accomplished for reasons of clearance and appearance. In any case, it is best to avoid the troubles that a system subject to shock would invite, by providing flexible means that will absorb these changes.

Underground Construction Standards at Worcester

TO INSURE uniform work and save time in the installation of underground conductors the Worcester Electric Light Company furnishes its construction forces with Lefax size sheets illustrating field methods and material as approved by the general superintendent, G. M. Hardy.



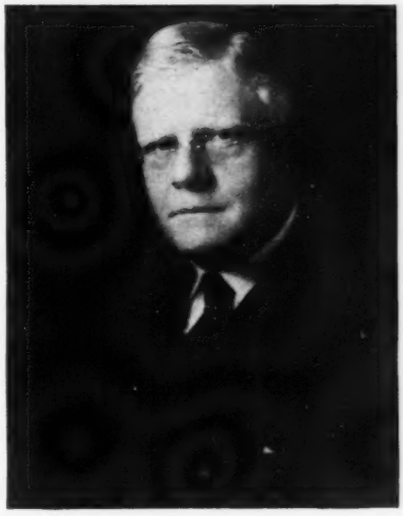
Underground practices standardized

(a) Cable pulling device, adjustable for varying manhole widths.
(b) Standard conduit rods.
(c) Brass bell for protecting cable from duct edge.
(d) Woven wire cable grip.
(e) Standard cable rack and hooks (Pierce), with size table; excessive sag is not permitted and no cable is allowed to remain on manhole floors.
(f) Method of attaching bond wire to cable sheath, using No. 6 B & S tinned copper, 49 strands.

The Manufacturer and the Stock Market

Current adjustments in credit policies and financing methods demand intimate knowledge of money market and stock exchange conditions

By H. Parker Willis



H. Parker Willis

MOST of the discussion of stock market conditions that has been current in recent weeks has concerned itself chiefly with those who are said to be "in" the market rather than with those who were "out" of it. As a matter of fact, the influence of the present market situation, and particularly of changing conditions in the credit field, has been more positive and direct, if anything, in its effect upon those who were not actively at work in a speculative way than upon those who had actual stock market commitments. This effect of changes in market prices and in credit conditions is of fundamental importance to the manufacturer among others in the business community, although in a good many cases he prides himself upon attending to his own affairs, and paying comparatively little attention to speculation.

It is, of course, true that many manufacturers devote about as much time to market analysis as they do to costs of production. Some of the larger enterprises of the country, with "finance committees" and other special organizations whose function it is to look after the monetary affairs of the corporation, are doubtless able, with the benefit of their "inside" information, to make large sums for themselves or for the management in general or, at times, for the general treasury of the corporation itself. As to the propriety of such action, it can only be said that public opinion is far from having crystallized, and that while eventually we may develop a standard of commercial ethics which looks with distaste upon speculative operations in the stock of a concern, conducted on behalf of "insiders," no such standard has thus far become generally accepted. It is still true that not only in the case of the large concerns, but often in that of the smaller enterprises and even of banks, some of those with special information about the affairs of the corporation which they are operating do not hesitate to buy and sell its securities and to make money for themselves—or at times lose it. Many a manufacturer is thus a close student of market conditions to the neglect of the productive side of his business. This kind of relationship between the business and the stock market and the credit situation is not, however, what is chiefly in mind in the present discussion. The real relationship between manufacturers as a class and market conditions is found in the larger financial aspects of the situation. Fundamentally, it centers around the question of the manufacturer's access to capital on the one hand and to short-term accommodation on the other. He is fundamentally interested in knowing how his cost of working capital is affected by changes in the rate of interest in the open market, and how his access to long-term capital, as well as the cost thereof, is affected by general movements of stocks and other securities. These movements he ought to study for the light they throw upon his current problem of financing, both as regards control of funds and their cost to him.

On the whole, manufacturers of the country have not thus far devoted an adequate amount of attention to this subject. A good many of them are situated in more or less remote and isolated places, and in a good many other instances they have thought it somewhat unprofessional to devote their attention to stock market operations. Even the money market has appeared to them a rather distant subject of study, and many have thought it far better worth while to "stick to their knitting," giving their study chiefly to cost of production and operations in their own plant, rather than allowing it to stray to topics that might appear to be somewhat remote from immediate actualities. They have been inclined to depend almost exclusively upon the country bank, as long as that institution was able to finance them, and when it was not so able, about all that they have thought of has been a shift to some bank in a neighboring city which might be able, by reason of its larger size and greater facilities, to accomplish results the country bank could not supply.

Within the past five years there has been a remark-

Apart from being a nationally and internationally known authority on banking and finance, Dr. Willis' close association with the building of the Federal Reserve System and his experience as first secretary of the Federal Reserve Board, as editor of the Journal of Commerce, New York, and as professor of banking at Columbia University equip him in a singular manner to discuss these credit and financial problems authoritatively.—EDITOR.

able alteration in these particulars, yet so slowly do such changes take effect that there are still large numbers of manufacturers who are not in line with the new point of view. The more alert heads of businesses have come more and more within the period in question to consider seriously the question of financing themselves, not through the home bank at all, but either in the open market for short term accommodation or in the investment market for capital funds. One result has been the enormous increase in the number of concerns listed on our stock exchanges and the much greater number of enterprises which, although not listed, have nevertheless undertaken to put their capital securities into the hands of a widely distributed public. In consequence, there has rapidly developed a widespread body of stockholders, scattered throughout the United States. It is estimated that whereas before the World War the number of regular security buyers was perhaps from 1,000,000 to 2,000,000, taking the United States as a whole, the number is today in the neighborhood of 15,000,000. Many persons who formerly confined their investments to government bonds, national, state or municipal, or who combined with these securities a few real estate mortgages, have developed into buyers, often too trustful and thoughtless, of industrial securities, which sometimes pay a good return but at other times hardly compensate for the risk that is run in connection with them. They are at all events a steadily growing and apparently convinced body of investors in such securities.

New Problem of Financing

The opening up of a new area of capital flotation and capital securities purchased naturally broadens and greatly changes the attitude of the manufacturer toward his own business. It is an unquestionable fact that there are many plants throughout the United States that find it difficult to compete with others because they are not supplied with up-to-date machinery, the getting of which involves an outlay to be borne only by the most economical and best access to the investor's pocketbook. This lack of equipment is not always recognized, but is often fully understood and attributed by the manufacturer to the fact that he cannot well obtain a larger capitalization. He finds it hard, perhaps, to float his securities locally, and harder still to induce the local bank to go much more deeply into the enterprise. Accordingly, he often has to sell out to the competitor, who, with no better technical knowledge or organization, is nevertheless able to supply himself with abundant capital, and thereby to make use of the most recent methods and the best organization of labor in the plant. It has, therefore, become essential that the manufacturing enterprise keep itself acquainted with the terms and conditions upon which it can obtain the funds with which to maintain its up-to-date efficiency. There has been a general impression in many quarters that only the large enterprise could finance itself at a distance, or could expect to succeed in issuing capital through an investment banking house. The experience of the past five years shows that this is an erroneous impression. There are many investment buyers who prefer the small, well-managed enterprise as a field for their funds and who believe that the spreading out of their capital over a number of such concerns is far wiser and safer than the policy of putting it into a single large undertaking.

Recognizing this new way of dealing with his capital problem, the manufacturer of the present moment naturally seeks for a way of constantly "sizing up" his position in the capital market and of comparing it with local credit situations. As a result, there has come about a great change in the method of handling credit at country banks. The high rate of interest charged to direct borrowers has driven many of its larger customers out of the local bank and into the capital market, while the local bank itself has found that it had surpluses of funds which it had to dispose of elsewhere. It has sent these funds to be loaned in the call market, or in many cases it has actually bought the securities of borrower concerns that had been refused new credit or had been accorded loans upon the same costly terms that had been named in years past. The local manufacturer, without realizing that he is participating in a rather revolutionary movement as regards the supply and distribution of credit, is nevertheless being driven by his own interest to become a student of rates for money and terms of accommodation in distant markets and has had to habituate himself to making his applications in those markets whenever circumstances appeared to compel it. In thus keeping track of what he can do, and of general competitive conditions, the manufacturer finds that a close study of two things is worth his while—the rate of interest prevailing in the New York and other money markets and the yield that is being furnished by securities in the same general class as those of his own enterprise. In order to understand what is going on in this regard, he obviously finds it necessary to keep in close touch with quotations relating to enterprises of his own general sort. In a good many cases he has been surprised to find how high a valuation was set on his securities by the market after it had become accustomed to them, and so had gradually formed the habit of making a correct estimate of the meaning of current condition statements. This is another way of saying that the manufacturer has been surprised to see at how low a rate of interest he could really borrow when he set about it, and when, accordingly, he had taken the necessary steps to establish his credit in the larger markets.

Some Essential Factors

Among the essential factors which are found useful in analyzing changing money conditions from the business man's standpoint is, of course, the changing rate of return for the best commercial paper, and at the same time the rate of discount charged by reserve banks. Along with these, the open market rate for call money is also worthy of scrutiny. An analytical study of the three types of interest rate contrasted with the quotation for bonds or other securities issued by kindred enterprises, and of the kind which the manufacturer would himself issue were he to become an applicant for new capital, results in showing him several things: The variation or difference between the lowest rates charged by banks for the best paper currently growing out of business operations, as compared with the value placed by the community upon long-term securities bearing a rate which must be paid by a representative firm in order to place its obligations. For example, suppose that, at a given moment, a manufacturing enterprise which has been in the habit of selling commercial paper in the open market at 4½ per cent finds that the rediscount rate is 4 per cent, while the 5 per cent bonds which the concern has outstanding are selling at par. It is evident that in this case the enterprise may provide itself with working capital more cheaply through the open money market than in any other way. Suppose, however, that a condition of tight money has set in, with the reserve discount

rate at 5 per cent, commercial paper at 5½ per cent, while the concern's bonds have now settled back to, say, 98. Evidently a long-term investor is willing to pay the concern $98 (less expenses of issue) for an obligation bearing 5 per cent on par. At the same time, the concern must pay 5½ per cent for open market money and will probably be charged the highest going rate by the local bank, especially if the latter has to rediscount. There is always an important field of choice for the active concern as to how it shall get its funds, and this choice involves more and more important considerations as the market tends to vary and to establish differentials between long-term and short-term investments.

Using the Corporate Surplus

Of late years there has appeared to be a converse side to this situation which has quite often been ignored. A great many enterprising concerns have in the past succeeded in financing themselves very fully, with the result they no longer find themselves in debt to banks, but on the contrary are possessed of a surplus of liquid capital which they can use when business is at all slack; since, working capital being sufficient for the "peak" requirements of the business, there is a surplus which can be used in periods of recession. What can be done with these funds? Until recent years manufacturers have been inclined to leave them idle in banks, at such rate of interest as the latter would pay, or quite frequently have invested them in safe bonds or other securities which could be disposed of when necessary. The selection of these investments has itself been a rather serious and difficult problem. More recently the manufacturer has found that he could put his spare funds out into the call market when rates were high and attractive, and he has been inclined to direct his banker or other representative to follow that course. The practice has spread more and more widely until, at the present time, official returns indicate that more than $2,000,000,000 is being used by stock brokers who have obtained it from "outside" sources, partly corporations not engaged in banking. This is another way of saying that the corporation engaged in business has found itself, on a good many occasions, disposed to go first into investment and then into money lending. Needless to say, such operations, involving, as they do, the use of the concern's fluid capital, and frequently its conversion from a funded form into a liquid form, ought not to be undertaken without very substantial acquaintance with the general market conditions and very considerable skill in selecting the times at which to go into, or withdraw from, the market. Put in another way, this amounts to saying that the new type of corporate financing, which aims to be independent of the bank at least in large measure, places upon the concern the necessity of keeping its funds wisely engaged, or, in other words, of becoming something of a banker itself. But successful performance of any such function calls for the attentive service of some officer of the corporation who is himself distinctly in touch with the money market and other conditions.

> . . . *"the growing breadth of the securities market may properly be viewed as reflecting, in an important degree, the opportunity for financing through the investment banking channel rather than through commercial banking, with all that this implies as regards careful executive study of market conditions and money rates."*
>
> . . . *"the securities market affords the best measure both of the terms upon which he (the corporation executive) can get capital and of the market rate of return which he can realize upon spare capital when he has any."*
>
> . . . *"more and more enterprises are becoming independent of their bankers, and in a sense are entering the market in competition with them."*

Large and Small Corporations

The opinion has been widely held that this kind of close study of the money market and this reliance upon open market financing in place of the old-time direct loan at the bank is possible only for large corporations. The term "large" is a rather vague one, but it certainly cannot be used in any very exclusive sense, since we have today listed on the New York Stock Exchange nearly 1,100 concerns, while on the Curb there are fully 1,000 others (including both listed securities and those admitted to trading). Taking the stock exchanges of the country as a whole, it seems probable that there must be at least as many more other enterprises that are regularly listed and traded in. In the case of some, the outstanding capitalization is not a large one as things go today, the listing having taken place at the instance of persons or institutions who desire to have as ready and liquid a market for their holdings as possible. More and more shares are being listed each year and more and more enterprises are assuming the corporate form, so that it would be certain that an increasing percentage of the corporate obligations of the country will be traded in by this means as time goes on. It is, of course, quite true that listing on the Stock or Curb exchange, or on any other, is by no means a necessary associate of resort to the investment market. Many enterprises get their capital through the investment market, without ever intending to list their securities, and there are many whose shares are listed who still stick to the old-fashioned plan of borrowing direct at the bank. But in a general way, the growth of active trading in securities means a corresponding opportunity for the placing of more securities, inasmuch as those already issued are known, recognized and valued. The upshot of the situation is, therefore, that the growing breadth of the securities market may properly be viewed as reflecting, in an important degree, the opportunity for financing through the investment banking channel rather than through commercial banking, with all that this implies as regards careful executive study of market conditions and money rates.

Probable Future Developments

The situation which has thus been set forth in very brief terms undoubtedly foreshadows much more extended development in the future. It seems probable that fewer and fewer large concerns will depend even primarily upon commercial banks. The latter, in fact, are furthering and promoting this change by their evident preference for secured paper as against straight commercial loans based upon a study of credit. As long as they take this point of view, and of course as long as rates of interest remain so irregularly adjusted be-

Cost of Electric Street Lights (Chicago, 1927)

	1,000-Cp. Lamps—20 Amp.		600-Cp. Lamps—20 Amp.		600-Cp. Lamps—10 Amp.		400-Cp. Lamps—6.6 Amp.		400 Cp. 15 Amp.	250 Cp. 6.6 Amp.	100 Cp. 6.6 Amp.	Total	100 Cp. 4 Amp.	Through Street Stop Lights	Traffic Signals
	Aerial	Underground	Aerial	Underground	Aerial	Underground	Aerial	Underground	Aerial	Underground	Underground	Street Lights	Underground		
Average number of lamps	1,991	431	20,721	3,156	2,869	628	179	432	4	17,373	19,934	75,991	8,273	633	974
Operation and Maintenance	$37,798.54	$8,181.41	$236,122.57	$35,960.98	$43,531.62	$9,528.71	$1,516.72	$3,660.53	$32.53	$97,036.19	$47,779.98	$541,221.96	$20,072.18	$1,009.19	$27,155.43
Electrical energy	13,564.23	2,936.30	67,447.25	10,272.84	9,338.65	2,044.16	576.31	1,390.87	12.88	36,631.19	20,790.68	176,555.74	11,550.38	806.18	4,922.54
Substation expense	10,064.95	2,178.71	47,167.56	7,184.06	12,044.63	2,633.33	782.83	1,889.40	6.24	31,384.12	8,189.12	140,149.97	12,183.25	68.26	3.72
Incandescent lamps	742.31	160.70	2,812.17	428.32	389.37	85.23	279.19	673.82	15.38	27,097.88	16,631.26	78,823.47	25,722.23	1,299.15	11,692.30
Globes, cleaning and patrolling	6,741.13	1,459.27	70,157.27	10,685.57	9,213.85	2,126.27	688.06	1,660.57		80,395.76	33,964.99	271,343.69	3,067.04	3,697.00	16,178.71
Labor—Renewals, repairs	464.30	100.51	25,170.19	3,833.66	2,514.11	550.33	10.97	26.46		6,481.65	11,340.58	53,559.80		50.51	5,930.54
Lamp fixture repairs	11,860.66	2,567.53			960.61	210.28	253.88	612.72	1.32	24,640.76	28,273.12	68,208.67			
Transformer maintenance		302.04	6,937.82	1,056.72		2,241.70	59.29	143.07		3,768.01	2,138.60	18,161.13	1,188.11		19,885.46
Multi-conductor cable in conduit	1,395.26	2,501.35		11,265.57				300.17		21,830.37	19,204.24	59,094.35	1,750.95		
Single-cond. lead-covered cable in conduit				582.47						2,297.36	2,636.03	10,839.46	5,323.60		
5,000-volt steel-taped cable								314.07		46,145.16	36,231.49	82,690.72	2,928.33		
600-volt lead-covered jute-covered cable	3,438.90	744.42	16,350.55	2,490.35	3,075.81	673.26	146.11	352.63	3.27	9,286.99	5,271.00	44,761.62	49,326.63	4,537.81	11,616.15
Underground conduit system				2,714.86		540.21			38.54	10,916.36	50,278.55	113,776.61			
Lamp post maintenance	19,187.16		199,687.17		27,648.40		1,725.01		4.14			248,286.28		870.45	3,221.39
Aerial maintenance	3,955.95	794.23	25,250.65	3,250.06	4,104.77	775.49	226.94	414.33	6.64	14,954.96	12,647.59	71,689.74	5,310.63	1,395.07	5,162.92
Automobile expense	6,340.21	1,272.91	40,469.17	5,208.86	6,578.71	1,242.86	363.72	664.05		23,968.30	20,270.28	114,897.06	8,511.35		
Overhead expense															
	$58.04	$53.83	$35.60	$30.08	$41.79	$36.07	$37.03	$28.02	$30.24	$25.15	$18.53	$27.56	$18.75	$21.69	$108.60
Cost per lamp															
Estimated Additional Charges	$13.92	$3.01	$69.21	$10.55	$9.59	$2.10	$0.56	$1.33	$0.14	$37.59	$21.34	$181.20	$11.86	57.43	212.75
Ground rent	261.00	52.40	1,666.00	214.43	270.83	51.17	15.00	27.33	.27	986.70	834.47	4,730.00	550.40	2,183.03	13,316.19
Office rent	17,656.38	8,299.03	120,802.48	40,815.43	18,964.14	9,153.03	734.90	2,021.93	16.42	4,179.68	86,751.52	413,360.58	33,965.64	3,536.64	21,573.03
Taxes	28,604.41	13,444.90	195,707.29	66,123.45	30,723.05	14,828.46	1,119.59	3,275.64	26.60	120,175.55	140,542.69	669,669.02	55,026.39	3,560.59	10,759.36
Depreciation	14,239.67	6,693.07	97,425.83	32,917.18	15,294.37	7,381.81	592.69	1,690.66	13.24	59,825.08	69,964.12	333,370.62	27,392.90	1,760.59	10,799.36
Interest	78.30	15.72	499.80	64.33	81.25	15.35	4.50	8.20	.08	296.01	250.34	1,419.00	105.12	17.23	63.77
Legal and other services															
	$30.56	$66.14	$20.08	$44.40	$22.78	$50.05	$14.18	$16.12	$14.19	$14.71	$14.97	$18.72	$14.12	$11.93	$47.13
Charges per lamp	$88.60	$119.97	$55.68	$74.48	$64.57	$86.12	$51.21	$44.14	$44.43	$39.86	$33.50	$46.28	$32.87	$33.62	$155.73
Complete cost per lamp															

tween the commercial and investment banking fields that business houses can get their capital cheaper in the latter, there is likely to be a growing tendency toward the putting of corporate obligations into long-term form, and therewith, the putting of the corporation itself into the market as a lender of funds to borrowers, whenever it has a surplus that is not being actively used in direct business operations. One natural outcome of this state of affairs has been the establishment of distinct financial departments in corporations, with competent staffs qualified to handle the banking and investment policies of the concerns. This tendency may be expected to increase, and as it does the corporation executive will find it more and more necessary to be himself a good deal of a banker and money authority. He will find it wise to keep in close touch with the securities market, not usually because he is a speculator or expects to "operate" either in his own issues or those of allied lines of business, but because the securities market affords the best measure both of the terms upon which he can get capital and of the market rate of return which he can realize upon spare capital when he has any such available.

Banker Naturally Critical of This New Development

It is not surprising that the banking community looks upon this development rather askance. It does not relish seeing its own field invaded by "outsiders," whom it regards as interlopers, in a kind of business transaction heretofore jealously reserved to members of the banking community. And yet more and more enterprises are becoming independent of their bankers, and in a sense are entering the market in competition with them. The new system has its hazards undoubtedly, but it also has large possible rewards. At all events it is a growing system and one for which the business man for once finds it necessary to equip himself with care. The new mode of financing affects the manufacturer and producer more closely probably than any other group in the community and his necessity of bringing himself into harmony with current tendencies is correspondingly greater.

Street Lighting Costs

COSTS of operation and maintenance of street lighting in Chicago for 1927 are shown in the accompanying table. The system is a municipal one and the compilation was made by the Department of Gas and Electricity and published in its annual report. The section of the table headed "Estimated Additional Charges" is added to the presentation of direct expenses incurred by the department in order to make the total cost per lamp in some degree comparable to the same item if the system were owned and operated by a privately owned utility. In studying this table it should be remembered that these additional charges are free estimates that may or may not be close to accuracy and can, in any case, be taken only as reasonable judgment on local conditions in Chicago.

Loads 5-Ton Truck in Ten Minutes

By Theodore R. Eilenberg
Structural Engineer
New York & Queens Electric Light & Power Company

THIS loading device has been used to great advantage by the New York & Queens Electric Light & Power Company on underground subway work for loading trucks. Our company finds that the machine is easily moved from place to place and can be used to advantage on streets having considerable traffic. After the machine is placed in position, three men shovel dirt onto the belt, which in turn conveys its load to the truck. Operated in this manner a 5-ton truck is loaded in from ten to twelve minutes; about 3 gal. of gasoline is consumed in an eight-hour day.

Eye-Conservation Appeal in Relighting Activities

By M. Luckiesh
Director Research Laboratory, National Lamp Works, Cleveland

WHEN the first home-relighting activities were undertaken a few years ago effective methods of selling better lighting in old homes had not been established. During the ensuing years information on this subject has been accruing, until today it appears that the way is no longer indefinite and unpromising. Notwithstanding this situation, there are still evidences of very much the same lack of understanding as was prevalent in the early days of home-relighting activities.

One group declares that new fixtures are needed because, artistically, the fixtures in use are out of date; a few argue that specification fixtures will turn the trick; some advocate that lighting effect is the thing, and others feel that the story of reducing the burdens in the home is sufficiently convincing. Each of these attacks has been featured more or less to the exclusion of the others and in practically every case only partial success has resulted.

Procrastination on the part of the buyer has to be overcome and none of these issues taken alone, or even several of them used together, seems to create the urge to act immediately.

Our connection with those activities from the beginning has given us opportunity to study the merits of various sales appeals. We cannot think of the home without thinking of children. Their eyes are immature in growth and in function and, therefore, they are readily susceptible to injury and malformation. Nearsightedness, eyestrain, nervousness and other disorders often result from inadequate and improper lighting. These and other similar arguments pertaining to better seeing and to conservation of vision urge immediate action on the part of the householder.

Convincing results have been obtained from certain recent home-relighting activities, of limited duration, based largely on the eye-conservation appeal.

	Lighting Fixtures
Ohio Public Service Company	5,884
Pennsylvania-Ohio Power & Light Company	2,546
Public Service Company of Colorado	3,498

In each of the cases the eye-conservation appeal was paramount and the commercial managers responsible are thoroughly convinced of the effectiveness of this appeal.

Obviously, a well-planned relighting activity utilizes fixtures which incorporate all the available arguments, but experience has shown that being "kind to the eyes" is the best framework for home-relighting activities.

Letters from Our Readers

Responsibility for Accidents

To the Editor of the Electrical World:

In the Oct. 13 issue of Electrical World you published some excerpts from my address on "Executive Responsibility for Accidents" given before the Great Lakes Division convention.

I am very glad, indeed, to see that your interest in accident prevention prompts you to give such splendid publicity to a paper on accident prevention and trust that such publicity will be given to an even greater extent in the future, as I feel that the various magazines of the electrical press are thoroughly read by nearly all of our executives and are the most effective agents in placing material before executives. A large proportion of the executives attending a convention will not stay to listen to a talk on accident prevention, but I think they will read the material when dressed up as you have done it on this occasion.

I wish to call your attention to the fact, however, that you made an error in stating that I am now chairman of the N.E.L.A. accident prevention committee. The chairmanship of this committee is now in the very able hands of C. R. Beardsley of the Brooklyn Edison Company, Pearl and Willoughby Streets, Brooklyn, N. Y., and I would be glad to have you correct this item.

K. R. MacKinnon,
General Superintendent.

Nebraska Power Company,
Omaha, Neb.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Progress in Central-Station Use of Pulverized Coal.—E. H. TENNEY.—A summary of experiences at the Cahokia generating station from standpoints of performance and of dollar value. In order to indicate the progress made with pulverized fuel the operating records of a series of five different pulverized-fuel-firing arrangements and furnace designs have been assembled pointing out the value of each arrangement for this particular plant. These comparative values depend upon the grade and price of coal used, the planned load factor and the rate for fixed charges. Notable savings have been realized and it is stated that these have been brought about by reduction in coal preparation cost, including the elimination of drying and transport equipment; general improvement in boiler economy, by development of the firing methods best adapted to the fuel; reduction in furnace maintenance by the use of water walls; elimination of hard slag in the furnace by horizontal firing; an increase in ratings by the use of water walls, turbulent firing, and draft equipment.—*Mechanical Engineering,* October, 1928.

Throat Conditions During the Adiabatic Flow of Mercury Vapor Through Nozzles.—W. J. KEARTON.—The simple or classical theory of the flow of vapor through a nozzle assumes that the expansion of the vapor takes place in thermal equilibrium, the relationship between pressure and volume being expressed by an elementary equation. The author has prepared a mathematical discussion of the thermodynamics of the situation, with particular reference to the critical pressure ratio of the vapor, which is initially superheated and becomes wet before the nozzle flow is reached. The phenomenon to which this paper draws particular attention is one which may also occur in the stable expansion of all vapors except those in which the derivative of the entropy of the dry and saturated vapor with respect to the temperature is positive.—*Engineering (England),* Oct. 12, 1928.

Generation, Control, Switching and Protection

The High-Speed Circuit Breaker.—W. H. THOMPSON.—The engineering and economic efficiencies involved in the development of the high-speed circuit breaker have been reviewed by the author. The importance of the time periods established for such equipment has been emphasized. Certain essential elements constituting the characteristics necessary for a true high-speed breaker are current-carrying capacity and contact pressures, to which are allied current density and contact area; the moving mass; the hold-on force; the opening force; the tripping agent and the arc-rupturing agent. These and several items are all considered by the author in their relation to a satisfactory design.—*Electrician (England),* Sept. 21, 1928.

Transmission, Substations and Distribution

Cable Joint Design and Construction.—A number of new or previously undescribed types of cable joints have come to the attention of the underground systems committee of the N.E.L.A. and are described in this report. Two large operating companies have contributed considerable material regarding the construction of duct splices, the use of which makes possible the salvaging for reinstallation of short lengths of cable. Reservoirs for attachment to joints to supply excess oil to splices and cable and also to limit, so far as possible, variations of internal pressures and vacua are said to be receiving considerable attention. Both constant volume, variable pressure, and constant pressure, variable volume containers are widely employed and much information has been made available by different companies on the amounts of oil which will migrate into cables under different conditions. A considerable section of the report is devoted to a discussion of insulating sleeves and sheath-bonding devices used to eliminate sheath losses in single-conductor cables. It is shown that the cost of these losses, plus the resulting decreased carrying capacity of the cables, much more than justifies the expense of the devices necessary for their prevention.—*Report National Electric Light Association,* September, 1928.

The Electrical Properties of Galvanized Steel Conductors for Overhead Transmission Lines.—E. C. WALTON.—The results of some work carried out with a view to obtaining definite information as to the electrical properties of steel conductors when carrying alternating currents is offered in this discussion. The most important values measured in the tests were the effective alternating-current resistance and internal inductive reactance, and it is shown that it would be impossible to calculate these in the case of iron or steel conductors. Full particulars with regard to the selected range of test samples have been included, indicating the mechanical properties, chemical analyses and magnetic qualities involved. The effect of spacing on the values of effective alternating-current resistance and internal inductive reactance is also considered, and test results indicate that these values do not vary with the spacing until the conductors are close.—*Journal of the Institution of Electrical Engineers (England),* October, 1928.

Units, Measurements and Instruments

Status of Candlepower Standards.—E. C. CRITTENDEN and J. FRANKLIN MEYER.—A description of the methods used in establishing primary and derived standards of candlepower at the Bureau of Standards. The international candle is maintained by means of 4 watts per candle carbon-filament lamps. The universal use of high-efficiency tungsten lamps has made it necessary to use vacuum tungsten lamps and gas-filled tungsten lamps as derived or secondary standards. These derived standards have been established by different methods at the several national standardizing laboratories and differences amounting to several per cent are known to exist. The authors propose that agreement be reached on a uniform method for evaluating the transmission of colored filters such as the blue glass filters prepared in accordance with the decision of the representatives of the national standardizing laboratories. It is proposed that in photometric measurements where color differences exist the values calculated from spectro-photometric data by means of the visibility factors provisionally accepted be taken as the standard values. *Report International Illumination Congress,* September, 1928.

Differential Intensity Sensitivity of the Ear for Pure Tones.—R. R. RIESZ. The ratio of the minimum perceptible increment in sound intensity to the total intensity has been designated by the author as the differential sensitivity of the ear. This was measured as a function of frequency and intensity. By means of the use of the method of heat this value was measured for practically the entire range of frequency and intensity for which the ear is capable of sensation. Data obtained as to the results of this investigation have been tabulated and charted in connection with an exposition of the determination.—*Reprint B-325, Bell Telephone Laboratories, Inc.*

Illumination

Tests of the Influence of Illumination on Production and Fatigue in Manual Work.—M. COHU.—A series of experiments have recently been undertaken and planned with the object of studying the effect of illumination on output of work. The first determinations have dealt with reaction time as a function of the illumination, and later investigations will cover the more complicated factors involved in certain work. Reaction times as described in this article have been measured for different subjects using a d'Arsonval chronoscope and the illuminations have been measured with an illuminometer. The results of these experiments indicate a very rapid diminution of reaction time from about

32-100ths of a second with illuminations of 4 to 5 lux to 20-100ths of a second with vertical illuminations of about 30 lux.—*Report International Illumination Congress,* September, 1928.

Electrophysics, Electrochemistry and Batteries

Some Problems in Electrical Machine Design Involving Elliptic Functions.—R. T. Coe and H. W. Taylor.—The authors have investigated four problems, three concerning the air-gap flux distribution of a machine for various conditions of slotting and grooving on one side of the gap and the other concerning the temperature distribution in the insulation between two conductors and the sides of a slot. The former have special reference to the subject of pole-face losses and experimental results available for one of the cases considered are found to be in satisfactory agreement with the theoretical results obtained. These four problems, which can all be treated as two-dimensional, are dealt with by the method of conformal transformation, and, by considering symmetrical figures, the results are obtained in the form of an equation involving elliptic functions. By means of a systematic treatment it is demonstrated that numerical results may be calculated from such expressions without the difficulties usually associated with elliptic functions.—*Philosphical Magazine (England),* July, 1928.

A Voltaic Hydrogen Generator.—W. Cecil Gardiner and G. A. Hulett.—A hydrogen generator has been designed which is self-contained and so does not require an external source of energy. It is essentially a voltaic cell where no oxygen is generated. The design is such that the electrolyte previously saturated with hydrogen completely fills the generator, leaving no dead space so that the first gas delivered is pure oxygen-free hydrogen. The method of using luminous bacteria for detecting a trace of oxygen in hydrogen is described as well as the testing of the hydrogen generator described in this article. The generator consists of an amount of amalgamated zinc anode and a platinum black or nickel cathode in an electrolyte of sodium hydroxide containing a little barium hydroxide. The generator operates at full capacity on short circuits, but may be controlled by introducing a variable resistance circuit.—*Report American Electrochemical Society,* September, 1928.

Electrochemical Tests of Cable Compounds.—J. Lagerqvist.—The choice of an insulating cable joint compound should not only be governed by its purely dielectric properties but the chemical and physical properties should also be carefully considered. Most of the cable breakdowns occur in the joints. This has caused the erroneous conception that such faults are due to the puncture of the compound in the joint. The fact is, however, that this compound is rarely stressed more than about 1,500 volts per millimeter, representing a safety factor of 25 times normal. However, physically unsuitable compounds may crack or may change their properties, due to great temperature variations, leading to a fault for that reason. A series of fourteen tests is described to check the chemical, physical and electrical properties of 23 compounds which are used for cable joints. —*Elektrotechnische Zeitschrift,* Sept. 20, 1928.

Heat Applications and Material Handling

Polarization and Resistivity in Nickel Plating Solutions.—Roy L. Dorrance and W. C. Gardiner.—Using a Haring cell, the anodic and cathodic polarizations and resistivities of various nickel-plating solutions were measured at 17 deg. C. The anodic polarization was considerably reduced by the presence of chloride ion, although no appreciable difference is noted in the action of the metallic ion, potassium, sodium, ammonium, nickel, or magnesium associated with the chloride ion. The effect of bromide ion is the same as for the chloride ion, while the fluoride ion does not materially reduce anodic polarization. Measurements were also made on other recommended solutions. —*Report American Electrochemical Society,* September, 1928.

Testing of Electric Ranges. — J. Opacki.—The novel method of measuring the efficiency of an electric range, described in this article, is applicable only for heat storage ranges, in which a relatively small heating element charges a large block of cast iron. The sides of the block are heavily insulated and the heating element is left on the line continuously with the exception of the peak-load hours. According to the new method, a small quantity of water in a standard aluminum vessel is evaporated repeatedly, each evaporation is measured with a stop watch, and the equivalent value of heat energy is computed. With these results a diagram is drawn which not only gives the characteristics and efficiency of that particular range, but indicates also its cooking capacity for any chosen menu.—*Bulletin de l'Association Suisse des Electriciens,* Sept. 22, 1928.

Telegraphy, Telephony, Radio and Signals

The Effect of Chemical Composition on the Sensitivity of Galena as a Radio-detector and the Cold Emission from Crystals.—Wakasabro Ogawa, Chujiro Nemoto and Seiji Kaneko.—The general relationship between the chemical composition and sensitivity of galena is investigated, and as a result many elements are found to be efficacious for the activation of that mineral. It is concluded that the activation of galena is chiefly accomplished by modifying its electron affinity through the addition of a small quantity of certain elements in a manner similar to that of thorium in tungsten in the thermionic filament. The possibility of rectification by electron emission in the cold state and of the phenomenon of the mechanism of contact has also been taken up.—*No. 230 Researches of the Electrotechnical Laboratory (Japan).*

Measurement of Inter-Electrode Admittance in Vacuum Tubes. — E. T. Hoch.—A description of the Colpitts-Campbell bridge as applied specifically to the measure of direct admittances in the vacuum tubes. The network of admittances involved in such a measurement and a description of the bridge and of the procedure involved in the present application as well as the precautions that must be observed to avoid difficulty have been given in this discussion. Data obtained as a result of experimental observations have been included for several tubes. Certain variations in the basic principle involved and the arrangement of apparatus permit flexibility in the measurement work and these changes have likewise been discussed by the author. — *Reprint B-305, Bell Telephone Laboratories, Inc.*

Miscellaneous

Electric Light and Power Rates in the United States.—The rate research committee of the N.E.L.A. deals mainly with rate forms, types and methods of analyses, and in its reports has endeavored to point out the advantages of the most suitable forms of rates which are beneficial both to the customer and to the company, as well as to comment on important events in rate matters occurring during the year, such as court and commission decisions, rate papers, the results of special research, etc. This year they have included an exposition of the purpose of a price policy and have compared rates under public and private ownership. Various tabulated data and charts indicate the trend which the committee has endeavored to demonstrate. The situation in Ontario receives particular attention and it is pointed out that there the domestic rates were lowered by raising power rates. The fundamental relationship between domestic and power rates is pointed out in this connection. — *Report National Electric Light Association,* September, 1928.

The Use of Simple Metallic Electrodes in the Potentiometric Titration of Acids and Bases.—John O. Closs and Louis Kahlberg.—The authors have concluded as a result of a series of observations that certain metals, namely tungsten, molybdenum, arsenic, antimony, bismuth, aluminum and tin, could be used as indicator electrodes in the potentiometric titration of acids and bases. The titration of various acids with sodium hydroxide was studied, using each of the above metals as an indicator electrode. The method was found to give satisfactory end-points in all cases. All of the metals studied with the exception of tin behaved in a similar manner. — *Report American Electrochemical Society,* September, 1928.

Book Reviews

Heaviside's Electrical Circuit Theory

By Louis Cohen. New York: McGraw-Hill Book Company, Inc. 169 pages, illustrated. Price, $2.50.

Oliver Heaviside was a great mathematician and a great physicist and contributed greatly to the development of electricity. But his genius was long unrecognized because of his original methods of presentation and his rather abstruse development of his subject. Within recent years several contributions to engineering literature have been made dealing with Heaviside and attempting to clarify his treatment of electrical theory. In this book Dr. Cohen has taken up the Heaviside circuit theory and dealt with it logically and in terms customary to the engineer. The subject is developed in a gradual way and with extreme clarity in expression and reasoning and Dr. Cohen has used many illustrations of theory principles. Many of these applications, such as filter circuits and artificial lines, are valuable contributions to engineering literature in themselves and others have application interest to many engineers. In brief, the book deals with operational calculus, the expansion theorem, electric filter circuits, ocean cables, transmission lines and artificial lines.

Dr. Cohen's book is an introduction to the method of analyzing electric circuits which was developed by Oliver Heaviside in the second volume of his "Electromagnetic Theory" and, to a limited extent, in his earlier "Electrical Papers." Whereas, however, Heaviside analyzed his problems from the physical point of view, adapting and shaping the mathematical processes to it, Dr. Cohen adopts at the outset the algebraical method. Thus the Heaviside expansion theorem is proved by the method of partial fractions. In Chapter VII Heaviside's own method of proof, based on the conjugate theorem of dynamics, is given as an example of how Heaviside proceeded in his own work, from the dynamical conception to the mathematical, instead of the reverse, a method which was followed by many of the great mathematical physicists. An illustration as to what the different terms of the expansion mean physically would have been very helpful here.

Chapter III discusses the theory of electric filters, which lends itself well to the illustration of the expansion theorem. The author extended the expansion formula from the application of unit emf. to the application of an alternating emf., and while the resulting formula is simple enough, the process of deriving it appears very cumbrous. Heaviside's own method, when dealing with an impressed alternating sinusoidal emf., is not referred to, though it appears to be capable of easy and rather simple extension, leading directly to the author's formulas (20), (21), and (22).

In Chapter IV the author treats of the theory of ocean cables with negligible inductance and leakance, which is the classical problem. In Chapter V, however, he discusses, under the name of "transmission lines," long circuits with their four constants, which, in the hands of Heaviside, led to the discovery of the distortionless circuit which is the foundation of modern long-distance telephony. Chapter VI deals with "lumpy" lines, first suggested by Heaviside in 1893, to be used later so effectively by Pupin and the Bell Telephone Company.

The book is well printed, the material is handled skilfully, but the absence of numerical examples is greatly to be deplored. These may be supplied in a future edition to aid the reader.

Patents, Law and Practice

By Oscar A. Geier. New York: Richards & Geier. Fourth edition. 46 pages.

Not much that has to do with patent law and practice relating thereto is left to the imagination in Geier's most recent revision of a publication which has already run in three editions. The general plan of the previous issues has been followed, but revisions are numerous. Since 1924, when a third edition of this publication left the press, several changes in rules of practice in the United States Patent Office have been made and several foreign countries have enforced industrial and commercial patent and property acts. The chief contribution of this fourth edition is the giving of accurate and thoroughly up-to-date information with regard to all these changes.

Practical Radio

By Moyer and Wostrel. New York: McGraw-Hill Book Company, Inc.

This book possesses to a large extent the virtue claimed by its name; the material in it is practical, or, at least, more nearly approaches that ideal than do the contents of the usual radio compendium. On the other hand, it is like the others in that, in the effort to reach the non-mathematical and non-engineering mind, it pays more attention to "what" than to "how" and "why." To turn again to commendation, it may quite safely be said that this book, in spite of the time lag between progress in any art and the recording thereof in the pages of books, is conspicuously close to the band wagon of the rapidly moving radio parade. The fact that this is the third revision of the original work in four years argues that the authors appreciate their responsibility in this regard. The various parts of radio broadcasting and receiving apparatus are separately treated and are also discussed in their diverse combinations in operating assemblies. The chapters on how to select a receiving set, on recognition and correction of the ills that afflict a receiver and on power supply devices are of particular interest. Altogether, this book can probably be classified as somewhat above the average of its kind.

Kurzgefasstes Handbuch der Elektrizitätszählertechnik

By Dr.-Ing. F. Berchtold. Stuttgart: Ferdinand Enke. 250 pages, 369 illustrations.

The author has, according to the preface, had as objectives: To give a comprehensive though compact survey of the essentials of meter practice in its various forms; exact but simple presentation; emphasis on fundamentals. To bring together in one book a discussion covering the whole meter field is worth while. Energy, reactive, ampere, volt-ampere and other meters are included; chemical types receive brief treatment. In general, the operation is explained physically rather than mathematically. The arrangement of material has made it possible to cover much ground in a limited space. In some instances condensation has been severe, particularly in relating text to diagrams, but brevity is scarcely to be expected except at the cost of increased effort by the reader. In part, the goal has been achieved by profuse use of diagrams. Commendably, they are real diagrams, big enough and simple enough to stand out clearly. Illustrations, well made, are confined to an appendix, where are assembled performance data, calibration characteristics and views of about twenty types of meters made by various German manufacturers.

Book Notes

ALTERNATING CURRENTS. By Chester L. Dawes. Vol. II of a Course in Electrical Engineering. Second edition. 618 pages, illustrated. New York: McGraw-Hill Book Company, Inc. Price, $4.

A thorough revision of this good text book and the incorporation of new material are the characteristics of the second edition. The standards of education have been raised, according to Professor Dawes, and, in the second edition, some more advanced material is used and some more special tools have been introduced for the solution of problems. The clarity of exposition, the carefully selected problems and the good illustrations are features of this text that make it popular with college teachers.

DIENST VOOR WATERKRACHT EN ELECTRICITEIT IN NEDERLANDSCH-INDIE. Tenth annual report, 1927. 111 pages, charts, maps. Bandoeng, Java, Dutch East Indies.

Progress in the utilization of the abundant water powers of the Dutch East Indies, in the construction of new plant and of new transmission lines, with rapidly growing energy output, continued during 1927. The report gives financial, hydraulic and electrical statistics.

Book Received

Problems in Alternating-Current Machinery. By Waldo V. Lyon. New York: McGraw-Hill Book Company, Inc. 243 pages, illustrated. Price, $2.25.

News of the Industry

The Election and the Electrical Industry

Herbert Hoover's Attitude Toward Power Development and Utility Regulation—Results in States and Municipalities That Have Special Electrical Interest

ELECTION to the Presidency of the United States of Herbert Hoover makes it of interest in the electrical industry to recall utterances of his made during his seven-year incumbency of the Secretaryship of Commerce that bear upon the question of power development and utility regulation. These utterances, from which extracts are reproduced on the following page, are in line with his well-known opposition to putting government into business—a political philosophy which he developed in general terms during the campaign just past. Though he refrained from any pledge or promise concerning Boulder Dam, Muscle Shoals or any other specific project, he made it clear that his opposition to federal generation of power did not necessarily extend to its production as a byproduct of national undertakings in the interest of flood control, improved navigation or some other constitutional federal purpose. He again emphasized his belief in utility regulation by the proper agencies.

New York in Statu Quo

New York State, where the development of hydro-electric power has long been a bone of political contention, presented more of interest to those especially interested in that matter than any other state. Governor Smith's plan of a water-power authority which should build dams and power houses by the issue of non-taxable bonds was indorsed in principle by the Democratic nominee, Franklin D. Roosevelt. His election (almost certain as this is written) in an exceedingly close fight and with a Republican Legislature may point to another two years of inaction, since the Legislature is little likely to fall in with any plan which Mr. Roosevelt would approve and since he in turn would probably veto any legislation designed to authorize fifty-year leases of power sites to private interests along the lines favored by Mr. Roosevelt's Republican opponent, Albert Ottinger, when he was Attorney-General.

Hunt of Arizona Defeated

In Arizona the success of Mr. Hoover may indicate a lessening of the opposition to the Boulder Dam project, which the Secretary of Commerce favored, though as a candidate for President he remained non-committal as to the governmental features of the Swing-Johnson bill. This indication is strengthened by the defeat of Governor Hunt, a determined opponent of Boulder Dam, in his seventh and only unsuccessful campaign for the chief magistracy of his state. Senator Ashurst (Democrat), an equally determined champion of Arizona's rights, was, however, re-elected, as were Governor Dern and Senator King of Utah, also against the Swing-Johnson bill.

San Francisco Upholds Charter

Important utility measures came before the San Francisco voters, three charter amendments being voted upon. All were defeated.

President-Elect Hoover

Amendment No. 23, which would have set up a scheme for financing acquisition or extension of public utilities by the city with bonds authorized by a majority vote and payable both as to principal and interest out of revenue only, lost by 95,348 to 34,852. At present the charter requires a two-thirds vote on bond issues and limits bonded indebtedness of the city to 12 per cent of the real and personal property in the city.

Amendment No. 22 would have created a public utilities commission of three, to be appointed by the Mayor and to have jurisdiction over all publicly owned and operated utilities. It went to defeat by 74,092 against 47,838. San Francisco now owns a hydro-electric power plant of approximately 100,000-hp. capacity with transmission line, but no distribution system, and entertains plans for acquiring one or both of the present privately owned distribution systems in the city. It also operates a street-railway system in competition with a private company and recently voted bonds for purchase of its domestic water system.

Under amendment No. 24 expiring franchises of the Market Street Railway Company would have been surrendered and revocable permits issued containing all the provisions of the original franchises, including the 5-cent fare. It was beaten by 93,849 to 67,770.

Incomplete state returns Wednesday indicated a majority vote for a constitutional amendment to modify the original principle of riparian rights by adopting a policy that these rights shall extend to beneficial use only of the water of California streams. The old English common law of riparian rights, established in 1850, granting every property owner a vested right to the natural flow of water in any stream that adjoined or passed through his property, has been the subject of much litigation and was the underlying cause of the famous Herminghaus suit against the Southern California Edison Company to enjoin it from storing water for power generation in mountain areas. It is the opinion of those who have studied the California water law that the proposed amendment, if approved, will do much to straighten out a complicated situation which in the past has hindered use of water for irrigation and power.

Southern California Wants Boulder Dam

Los Angeles and ten other southern California municipalities voted by large majorities in favor of organizing a metropolitan water district to bring a domestic supply of water to the southland after the Boulder Canyon Dam is constructed on the Colorado River. On the face of incomplete returns Orange and Glendora were the only cities that voted against entering the proposed district. Los Angeles, Pasadena, Beverly Hills, Glendale, Santa Monica, San Marino, Santa Ana, Anaheim, San Bernardino, Burbank and Colton voted favorably. Incomplete returns indicate that Los Angeles voted in favor of joining the district by a four-to-one majority, Pasadena by a ten-to-one majority, with the other nine cities reporting better than a three-to-one majority in favor of the move. Until all the returns are in Chairman Hiram W. Wadsworth of the Colorado River Aqueduct Association, which sponsored the formation of the metropolitan water district, declined to make a state-

ment beyond saying that he is gratified over the results.

Chairman Clayton R. Taylor of the Board of City Directors of Pasadena said: "The large affirmative vote given in Pasadena and other southern Californian cities constitutes a direct and telling message to the United States Senate, which we trust will result in favorable action by that body during the ensuing session of Congress when the Swing-Johnson bill on the Boulder Dam will come up for action."

Oregon Won't Close Rivers

Based on returns from 1,011 out of 1,783 precincts in the State of Oregon, the four river-closing measures appearing on the state ballot by initiative petition will be defeated by virtually two to one. These bills, each restricting appropriation of water from a different river, received in the early returns referred to about the same number of votes for and against, indicating that the voters treated the measures pretty much as a unit involving a single principle. Returns from counties outside Multnomah (Portland), where the margin against the bills was narrower, indicate that the final vote will show a margin of greater than two to one against them.

The measures were designed to protect game fishing on the Rogue, Umpqua, Mackenzie and Deschutes Rivers and would have prohibited any further appropriation of water from these streams and their tributaries for commercial or municipal purposes or for irrigation. The power interests formed the chief point of attack in the campaign conducted by their sponsors.

A typical vote in the early returns available is that on the Mackenzie River bill, showing 32,121 for closing and 60,052 against. A slightly greater margin was recorded against the other three bills.

American Standards Association Now Functions

William J. Serrill Made First President—Farrell, Cortelyou, Lieb, Loree and Swope Are Members of Advisory Committee

UNANIMOUS approval by the 37 member bodies represented in the American Engineering Standards Committee has, as briefly announced last week, brought about its extinction and the establishment to take its place of the American Standards Association. William J. Serrill, assistant general manager of the United Gas Improvement Company of Philadelphia, who was the last chairman of the A.E.S.C., becomes president of the new organization, of which Cloyd Chapman is vice-president, P. A. Agnew secretary and F. J. Schlink assistant secretary. The advisory committee of the industrial executives includes J. A. Farrell, president United States Steel Corporation, chairman; G. B. Cortelyou, president Consolidated Gas Company; J. W. Lieb, senior vice-president New York Edison Company; L. F. Loree, president Delaware & Hudson Company, and Gerard Swope, president General Electric Company.

One of the most important results of the abandonment of the committee form of organization will, according to Mr. Serrill, be a much greater degree of participation by trade associations in the direction of the national industrial standardization movement. A board of directors composed of twelve industrial executives will soon be created and will control the general administration and policies of the association. The old main committee, made up of representatives of all the member bodies, now becomes the Standards Council, and in its hands will rest all matters connected with the adoption and approval of national standards.

The American Engineering Standards Committee was organized in 1917 by the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Testing Materials. The purpose of the organization was to provide a method of co-operation which would prevent duplication in standardization work and the promulgation of conflicting standards. The United States Departments of War, Navy and Commerce became members of the committee in 1919. Besides the 37 member bodies, there are 350 sustaining members, including manufacturers, distributors, associations, etc.

A broad range of industries and of types of standards will be included in the work of the new association. The following types are covered:

1. Nomenclature—definitions of technical terms used in specifications and contracts and in other technical work.
2. Uniformity in dimensions necessary to secure interchangeability of parts and supplies and the interworking of apparatus.
3. Quality specifications for materials and equipment.
4. Methods of test.
5. Ratings of machinery and apparatus which establish test limits under specified conditions as a basis of purchase specifications, or which establish requirements as to performance, durability, safety, etc., under operation.
6. The codifying of provisions for safety.
7. Rules for the operation of apparatus and machinery in industrial establishments.
8. Concentration upon the optimum number of types, sizes and grades of manufactured products.

The method of work is simply a systematic plan of co-operation by

Power Development and Government Ownership

I do not propose to refer to this evolution as either "superpower" or "giant power." . . . The practical every-day fact is that all this development is simply centralization of power houses and interconnection of distributing systems. If anybody can find evil or humor or poetry in these terms, he will need be ingenious. . . . There is some anxiety in the public mind as to whether public interest is or will be adequately protected in this great transformation. We must face the fact that, in order for these economies to be brought about, the power industry evolves from a single-town enterprise to large district enterprises. These fundamental changes have necessitated the raising of vast sums—now nearly $2,000,000,000 per annum. The technology of central generation and interconnection requires that the business must grow in the size of capital necessary for great power houses and district systems if we would have the benefits of low-priced power. We cannot buy 100,000 hp. generators at a 10-cent store. It implies vast consolidations and a large number of cross contracts, enormous commercial transactions and great security issues.—*Speech by Herbert Hoover before the N.E.L.A. convention at Atlantic City in June, 1925, in favor of state as opposed to federal regulation.*

If we pile these $40,000,000,000 of business and 2,700,000 employees upon the government, one of two things happens. Either the 530 members of Congress or the hundreds of members of state legislatures become their real boards of directors, or, as it has been claimed, these great businesses could be placed in the hands of non-partisan commissions or government corporations, somehow free from politics and the dead hand of bureaucracy. Neither alternative will work. If we were to set up such agencies, so free from restraint of the Congress and legislatures as to accomplish these objects, we would have created gigantic despotisms controlling the well-being of our whole people—and incidentally controlling the very election of our officials. As a matter of fact, we can do nothing of this kind if we are to maintain a democracy. . . . No great business can be efficiently managed by such a board or such a basis of choice. We shall convert business into politics and surrender efficiency for spoils. If we distribute railway extensions as we distribute public buildings, if we locate electric power plants as we locate reclamation projects, . . . then, as surely as night follows day, facilities will be wastefully provided for those districts or groups which are politically strong. —*Speech by Herbert Hoover at Washington, September, 1924.*

which organizations interested in any particular project participate (1) in deciding whether the work shall be undertaken at all, (2) in formulating the standard, and (3) in its ultimate approval as an "American standard." The decision as to whether work on a standard shall be undertaken is made by a general conference of representatives of all the groups concerned with the standard or by any equivalent method which assures a consensus of opinion. One of the most important results of the reorganization is the more flexible procedure for adopting standards now available. Four methods are provided:

1. By sectional committees, which are essentially joint committees made up of officially accredited representatives of all groups having an important interest. The sectional committees may work (a) under the administrative support and direction of one or more of the bodies principally concerned, termed "sponsors," or (b) autonomously, reporting directly to the American Standards Association.

2. The approval of existing standards when it may be shown that the standard represents a real consensus.

3. By the approval of "proprietary" standards when it may be shown that they are supported by a consensus of those substantially concerned.

4. By the official acceptance of the interested groups concerned.

Diversified Topics Interest A.I.E.E. Men

These Range from the Development of Power Systems and Descriptions of Southeastern Developments to Carrier Communication, Tests and Textile-Mill Drive

CO-ORDINATED power-system development, power-limit and short-circuit tests, power-line carrier communication, high-voltage flashovers and electric drive for textile mills were the chief topics covered at the regional meeting of the American Institute of Electrical Engineers held at the Biltmore Hotel, Atlanta, Oct. 29-31. About four hundred were registered at the meeting, and there was very real interest in the five technical sessions as well as in the other features of the gathering.

A session on power developments on Monday afternoon was presided over by Vice-President C. O. Bickelhaupt. A paper was presented on "Economies in Central Power Service," by W. S. Lee of the Duke Power Company, and one on "The Southeastern Power & Light Company's System," by A. T. Hutchins of the Alabama Power Company. Mr. Lee invited the attention of the engineering profession to the economies which may be obtained by co-ordinating hydro and steam power stations of various kinds and electric transmission and distribution lines serving a large industrial territory in a unified and centrally controlled system, using for illustration the generating and distribution system of the Duke Power Company. Mr. Hutchins reported interesting features of development and operation on the Southeastern system.

In the ensuing discussion W. E. Mitchell, Georgia Power Company, emphasized the necessity for developing plants for the best economic efficiency as distinguished from fuel efficiency. Mr. Lee, alluding to Mr. Hutchins' paper, said that his own company decided on the same type of plant for the River Bend station as the Alabama Power Company steam station No. 4, choosing 450-lb. boiler pressure instead of 1,200-lb. because the boiler equipment costs 15 per cent less, notwithstanding that with the higher pressure there would be a saving of 13 per cent in coal. The use of higher pressures, he added, seems to offer great promise for the future, but at present they are not economical except for continuous non-varying loads.

This session closed with an excellent lecture on "Translations Between Sound and Light," by J. B. Taylor, of the General Electric Company.

Carrier Communication

Power-line carrier communication and supervisory control were discussed at the Tuesday morning session, at which Prof. W. S. Rodman of the University of Virginia presided. Papers were presented on "Carrier Current and Supervisory Control on the Alabama Power Company's System," by W. I. Woodcock and E. W. Robinson, and on "Line Characteristics for Carrier Communication," by C. A. Boddie and R. C. Curtis of the Westinghouse Electric & Manufacturing Company. A sketch of the early development of such systems was given, followed by descriptions of systems installed later.

In discussing these papers C. F. Boeck of the Bell Telephone Laboratories suggested that equipment for communication over power lines should give reliability even if this requires some sacrifice of simplicity. He believed that the best system from the standpoint of reliability and other merits is the single-frequency, single-sideband system. L. E. Anderson of the Georgia Power Company urged that manufacturers of carrier equipment co-operate with each other so that one system will not render imoperative an adjacent system made by another manufacturer. He said that on his company's lines one system is sometimes paralyzed by another higher-powered system operating on lines as far away as 400 miles. L. G. Huggins of the Westinghouse company drew attention to a unique method of charging storage batteries used at remote points on the Alabama Power Company's system. The batteries are charged by a trickle charger having a dry rectifier, the charger being energized by alternating current drawn from a secondary winding on the drainage coil connected to the overhead ground wire of the line.

R. G. McCurdy of the American Telephone & Telegraph Company pointed out a number of advantages in employing a frequency above 50,000 cycles for power-line communication. Among the advantages in using higher frequencies are that cross-talk is reduced, the action of choke coils is better and the inductive effect on adjacent telephone lines is diminished since these lines operate below 50,000 cycles. C. A. Boddie, commenting on Mr. Boeck's discussion, said that simplicity and reliability usually go together. He believed the adoption of the single-frequency single-sideband system is a move in the wrong direction and said that the two-frequency, double-sideband system is giving very good results for both the Alabama Power Company and the Pacific Gas & Electric Company.

High-Voltage Flashovers

The last two papers in this session were on "Impulse Flashover of Insulators," by J. J. Torok and W. Ramberg, of the Westinghouse company, and "A Study of High-Voltage Flashovers," by J. T. Lusignan, Jr., of the General Electric Company. The former was for the most part a discussion of the mechanism of insulator flashover. The breakdown of air between electrodes, with particular consideration of the effect of various factors upon the flashover characteristics of insulator strings equipped with arcing rings, was discussed. It was shown that critical dimensions and spacings of arcing rings exist for a given insulator string.

Mr. Lusignan's paper gave a brief discussion of the various forms of electrical discharges as they are characterized by the physicists.

In a written discussion A. O. Austin of the Ohio Insulator Company pointed out many features in connection with insulator flashover and stated that the first impulse of dissipation of energy is very large and is possibly so rapid that it cannot be followed by the cathode-ray oscillograph. E. H. Rowland of the Locke Insulator Company claimed that experience has proved that continuous rings at top and bottom of an insulator string give the best protection and that a flat-strap ring gives better protection against steep impulses than a ring of circular or oval cross-section.

W. A. Kates and E. D. Tanzer of Day & Zimmermann said in a written comment that in making flashover tests the amount of energy available in the test set should be considered when drawing conclusions on actual line conditions where the amount of energy is very large. L. E. Reukema gave a written physical explanation of many of the test results recorded in Dr. Lusignan's paper.

Textile Session

A session on electric drive in textile mills was held on Wednesday morning, at which C. A. Collier of the Georgia Power Company presided. The papers presented were: "Variable-Speed Spinning of Cotton Yarn," by E. A. Un-

tersee of the General Electric Company; "Motor Drives for Cards and Roving Frames," by H. W. Reding of the Westinghouse company; "Electrification of the Textile Industry in the Southeast," by E. M. Clapp of the Central Georgia Power Company and A. G. Stanford of Robert & Company.

In the discussion two advantages of individual electric drive were emphasized in addition to numerous advantages mentioned in the papers. These were the advantages of cleanliness and of safety to the operators. C. A. Collier pointed out that the power factor of individual drives is rather low and that power-factor correction becomes important when a large load of individual drives is assumed by a power company.

The last session dealt with power-limit and short-circuit tests, automatic oscillographs and glow-discharge and photoelectric devices. The four papers presented at this session, at which W. E. Mitchell of the Georgia Power Company, presided, were: "Power-Limit Tests on Southeastern Power & Light Company's System," by S. M. Jones of the Alabama Power Company and Robert Treat of the General Electric Company; "Application of Auto-Oscillograph Equipment for Power Systems," by A. Dovjikov of the Westinghouse company; "Photo-Electric and Glow-Discharge Devices," by J. V. Breisky and E. O. Erickson of the Westinghouse company, and "Short Circuit Testing on the Alabama Power Company's System," by H. J. Scholz of the Southeastern Engineering Company and C. B. Hawkins of the Alabama Power.

In the first of these papers it was explained that as a result of certain troubles which occurred on the Southeastern Power & Light Company's system in 1925, apparently due to instability, it was decided to attempt to determine by actual tests the amount of power which could be safely carried over certain transmission lines and to compare the results with the calculated values. The General Electric Company co-operated with the engineers of the power company in conducting such tests.

In the discussion of Mr. Dovjikov's paper, E. E. George of the Tennessee Electric Power Company said that quick-trip ammeters have been found very helpful in making rapid analyses of system troubles. With these ammeters the records are instantly available and there is no delay such as is necessary for the development of oscillograph films. Mr. Dovjikov pointed out that these ammeter records do not give accurate numerical values, though they are useful as fault indicators.

Messrs. Breisky and Erickson told about the application in industrial operations of the apparatus they described.

The paper by Messrs. Scholz and Hawkins gave a description of the modern test equipment installed in the last two years and the method of procedure in making tests. It was brought out that the expenditures for complete testing facilities have been fully justified and have resulted in the installation of better equipment, improved protection and a higher grade of service to customers.

Among the other events of the regional meeting were a student session, at which five enrolled students of Institute branches presented papers; a lecture on "Science and Research in Telephone Development," by S. P. Grace of the Bell Telephone Laboratories, several inspection trips and a dinner-dance.

N.E.L.A. Engineers to Study Electrification in Europe

A sub-committee of four members of the N.E.L.A. committee on the electrification of steam railroads has been appointed to report on important European railroad electrifications and the power plants serving them. This sub-committee, which has already arrived in Europe to begin its work, comprises L. E. Fischer, Illinois Power & Light Corporation, chairman; Horace H. Field, Public Service Company of Northern Illinois; Reinier Beeuwkes, Chicago, Milwaukee & St. Paul Railway Company, and Harley A. Johnson, Chicago Rapid Transit Company.

Impregnated Paper Insulation Subject of Research

Below are the titles and authors of the papers to be read at the conference on impregnated paper insulation which will be held under the auspices of the committee on electrical insulation of the National Research Council, meeting at the School of Engineering, Johns Hopkins University, Baltimore, on Nov. 16 and 17:

FRIDAY MORNING, Nov. 16

"Public Utilities and Research," D. W. Roper, Commonwealth Edison Company.

"Study of the Mechanism of Cable Deterioration," C. F. Hirshfeld, Detroit Edison Company.

"Apparatus for Bombarding Liquid Dielectrics with Ions of Either Sign," Prof. V. Karapetoff, Cornell University.

"Investigations of Current Wave Forms in Composite Dielectrics Under High Stress," W. F. Davidson, Brooklyn Edison Company.

"High-Tension Underground Cable Research and Development," G. B. Shanklin and G. M. J. Mackay, General Electric Company.

SATURDAY MORNING, Nov. 17

"Suppression of Edge Effect in Breakdown Tests and Its Consequences," Prof. V. Bush, Massachusetts Institute of Technology.

"Losses in Solid Dielectrics and in Ionized Gas Films," Prof. C. L. Dawes, Harvard University.

"Detection of Electrical Discharges in High-Voltage Cables," Prof. E. B. Paine, University of Illinois.

On Friday afternoon Prof. J. B. Whitehead of Johns Hopkins will give a description of work in progress in electrical engineering laboratories. At noon on Saturday the committee will meet under his chairmanship, all members of the conference being invited.

Southeastern Engineers Meet in Atlanta

Committees of the Engineering Section of the Southeastern Division, N.E.L.A., met in Atlanta at the Biltmore Hotel on Nov. 1 and 2 with a large attendance from the various states of the division. The first day was given over entirely to individual committee meetings with a dinner meeting in the evening. The second day was devoted to a general meeting of all committees with a luncheon meeting of the section committee chairmen.

The overhead systems committee and inductive co-ordination committee had a joint meeting, at which the various phases of the 1928 edition of the National Electrical Code were discussed, as well as the progress being made by the joint development and research sub-committee composed of representatives of the N.E.L.A. and the Bell Telephone systems.

R. J. Howe of the Western Union Telegraph Company, New York, presented a paper on the subject of wooden-pole treatment, with particular reference to the laboratory work in this connection that has been carried on by his own company. Another feature of the meeting was the motion-picture demonstration of cable manufacture which was made by T. F. Peterson of the American Steel & Wire Company.

Charles A. Collier, commercial vice-president of the Georgia Power Company, as president of the Southeastern Division, was the principal speaker at the dinner meeting. He touched on the commercial activities of the central stations and explained how these activities presented wider opportunities to the engineer.

Great Lakes Commercial Men Organize for Year

Organization of committees for the coming year was the chief occupation of the Great Lakes Commercial Section of the N.E.L.A. at its meeting in Chicago Nov. 2. Four commercial branches were represented—merchandising, lighting, customer relations and power sales—and about eighty men attended. The subject named last was covered by the Great Lakes Power Club, which is separate from but functions as a part of the local N.E.L.A. organization. This body gave most of the time available to an animated discussion of oil-engine and gas-engine competition, E. H. Purdy of the Consumers Power Company reading a paper on that topic.

A report was presented at the meeting of the merchandising committee on the lamp sales activity now in progress in the Great Lakes region. Excluding those companies that have free lamp renewal policies, more than 75 per cent of the meters in the territory are represented by the companies engaged in the campaign. An electrical advertising school is planned for Jan. 21-24 at Chicago. This school will be opened to all concerned with electric signs, their sale and operation.

Purchases and Mergers

Texas Municipal Plant Brings $1,580,000 from Insull Subsidiary—Wisconsin Municipal Plant Goes to Byllesby for $265,000—Other Sales

HARLINGEN (Tex.) voters have accepted the offer of the Central Power & Light Company, an Insull subsidiary, to purchase the municipal electric light and power plant and water supply system for a consideration of $1,580,000, equivalent to the total bonded indebtedness of the city, which the company has assumed. The value of the public utilities involved was placed at approximately $850,000 by the municipal officials. The campaign for the sale of the plant to the Central Power & Light Company was vigorously promoted by the company. The plant will be connected with the company's transmission lines in the lower Rio Grande Valley.

Citizens of Eagle River, Wis., voted recently, by 308 to 144, to sell their municipally owned power plant to a private utility, and accordingly the Town Board has sold the plant to the highest bidder, the Wisconsin Valley Electric Company, of Wausau, a Byllesby property, for the sum of $265,000. By this action the private company gains possession of Eagle River's power dam and all of its electric lines and equipment included in the two distribution systems outside its limits. Improvements will begin immediately.

The New York Power & Light Corporation, Albany, has filed a certificate in the office of the Secretary of State announcing the merger with it of the Port Henry Light, Heat & Power Company. Other certificates make formal announcement that the Central Hudson Gas & Electric Corporation has merged the Red Hook Light & Power Company and the Millerton Electric Light Company.

The Otter Tail Power Company of Fergus Falls, Minn., has bought the electric light systems at Callaway, Ogema and Waubun, Minn., with about 24 miles of transmission lines connecting these towns. These towns have heretofore obtained energy from the purchasing company.

Voters of Minburn, Iowa, have voted approval of the sale of the municipal light and power plant to the Iowa Power & Light Company. A franchise for 25 years was granted to the purchaser.

The school board of Marenisco, Mich., has sold its light and power lines to the Lake Superior District Power Company of Ashland, Wis. The school board has had charge of furnishing light and power for its community for several years.

A proposal to purchase the municipal light and power plant of Vinton, Iowa, has been made to officials of that city by the Iowa Railway & Light Corporation of Cedar Rapids.

The Missouri Public Service Commission on Oct. 29 held a hearing on the application of the Union Electric Light & Power Company of St. Louis to purchase from the North American Company the Union Electric Light & Power Company of Illinois, the East St. Louis Power & Light Company, three railway companies and a gas company. The Union Electric would pay $18,111,000 for the properties, including 420,000 shares of common stock on the basis of $25 a share and $7,611,000 in cash.

The Idaho Power Company will take over the Murtaugh Light & Power Company, a co-operative enterprise that has distributed Idaho Power Company energy in the vicinity of Murtaugh for about ten years. The merchandising company will rehabilitate the system and provide irrigation pumping service.

Purchase of the Mount Spokane Power Company, Deer Park, Wash., operated for several years by Mark F. Mendenhall, has been completed by the W. B. Foshay Company of Minneapolis. The newly acquired properties serve Deer Park and eighteen other towns in Spokane County with electrical energy. They will be operated by and as a part of the Public Utilities Consolidated Corporation, the operating company for the Foshay organization.

A fight is looming between private interests to gain control of the power situation in the Sudbury district of Ontario. These interests, taking time by the forelock and preparing for future developments industrially, are trying to get a foothold through the purchase of the Wahnapitai Power Company's holdings. It is understood that an option has been taken by one group on certain stock which, if exercised, will give the new interests a controlling hand in the power situation. The option expires Nov. 20. The company has now three plants with a total capacity of about 13,000 hp. It supplies power to the town of Sudbury and to mining companies.

Directors of the Northern Canada Power Company and the Northern Ontario Light & Power Company have agreed upon an amalgamation. The matter will be placed before shareholders of the two companies at a meeting in Montreal on Dec. 10. These companies are both subsidiaries of the Canada Northern Power Corporation, which owns more than 90 per cent of the outstanding common stock in each case. They both operate in the mining fields of northern Ontario.

California Edison to Rebuild Ninteeenth-Century Plant

Plans have been completed by the Southern California Edison Company to entirely rebuild its Kaweah No. 1 and No. 2 hydro-electric plants and make these two units entirely automatic. Kaweah No. 1, with a capacity of 1,900 hp., was built in 1899. This plant has three generators and is one of the oldest hydro-electric plants on the Edison system. Kaweah No. 2 was built five years later and also has a capacity of 1,900 hp.

The changing of these two plants into full automatic will effect considerable economy in operating cost. Plant No. 1 now has an operator on shift at all times. In the new plant there will be only one unit installed, with a capacity of 3,100 hp., and the full automatic equipment will eliminate the necessity of having any operator in the plant. Ordinary interruptions will throw the generator off the line, and when normal conditions have been restored it will go back automatically. There will be one operator at power house No. 2 who will be able to take care of both plants, which are approximately 1½ miles apart. Electricity developed at these plants is poured into the San Joaquin Valley to help take care of the demand of this territory.

At plant No. 2 the old 1,900-hp. equipment will be replaced with one single unit with a capacity of 2,500 hp. Kaweah No. 1 is to operate under a head of 1,300 ft., while No. 2 is to operate with a head of 360 ft. There is practically no storage on this river, but there is sufficient flow throughout the year to make it possible to operate the machines throughout the year.

Dunkirk, N. Y., May Become Site for 125,000-Hp. Project

The report on flood conditions at Pittsburgh for which Congress made special provision is expected to be in the hands of the Chief of Engineers by the middle of November. It is understood that, among other things, this report will recommend the diversion of water from the upper Allegheny River into Lake Erie during high-water stages at Pittsburgh. Such diversion, it is claimed, will be of advantage in raising the levels of Lakes Erie and Ontario and also will make possible more power development at Niagara. It is estimated that 100,000 kw. of primary power will be made available at Dunkirk, N. Y., where the water will be discharged into Lake Erie.

Progress has been such on the power, flood-control and irrigation surveys of the nation's streams authorized under the flood control act of 1928 that the office of the Chief of Engineers expects that half of the reports will be completed by the first of the year. Attention has been called to the fact that there is a scarcity in the number of competent hydraulic engineers available because of the great number required in the execution of this work. The progress of the work is being watched closely by the engineer's staff in Washington, and charts have been set up recording the status of the project on the streams and rivers of each of the 42 engineering districts.

Pioneer Boston Railroad Electrification Starts

Electric train service by the Boston, Revere Beach & Lynn Railroad, a narrow-gage line serving the suburban district between East Boston and Lynn, has now been operated for two weeks. Twenty-six steam locomotives will be replaced by motor cars as fast as the installation of electrical equipment can be completed. President Gardner F. Wells announced on the opening day that as soon as full service is inaugurated the running time over the 12-mile stretch between Lynn and Boston will be reduced by ten to fifteen minutes, or about one-third. About fifteen million passengers are carried on the road per year, and the cost of the electrification is estimated at about $1,000,000. Electrical energy is supplied by the catenary trolley system from substations served by the Edison Electric Illuminating Company of Boston at Orient Heights and by the Lynn Gas & Electric Company at West Lynn. The Boston Edison company will supply two-thirds of the energy required.

Now for Big Fifteen-Mile Falls Plant

New England Power Association Clearing the Way for Construction of Its Hydro Station on the Upper Connecticut—Upper and Lower Developments.

TENTATIVE plans for the development of Fifteen-Mile Falls, on the upper Connecticut River, where a development of 200,000 hp. at a cost of $40,000,000 is the ultimate goal, have been made public by engineers of the New England Power Association, the organization behind the project. These plans are naturally subject to some changes as final plans are formulated.

This development is divided into two distinct parts, known as the lower development, 1.7 miles north of the confluence of the Passumpsic and Connecticut Rivers, in the town of Barnet on the Vermont side and in the town of Monroe on the New Hampshire side, and the upper development, seven miles north of this point, in the town of Waterford on the Vermont side and the town of Littleton on the New Hampshire side. A great deal of the work to be done immediately is common to both developments, but the present effort is for early completion of the lower development, which the association expects to have in operation in the fall of 1930.

At the lower development a dam 170 ft. high will be built at a point almost at the foot of the falls. This will be of the modified hydraulic-filled earth type on the New Hampshire side and of concrete spillway section on the Vermont side, with the power house in the river bed. The dam and spillway at this lower development will be about 2,300 ft. long, with a maximum width of the earth dam of 1,000 ft. and the width at the crest about 25 ft. A permanent railway will be built on top of this dam.

The length of the spillway section is in the neighborhood of 865 ft. The reservoir created by this dam will be about 8 miles long and will cover an area of 1,100 acres. This reservoir will have a capacity of approximately 55,000 acre-feet, or 18,000,000,000 gal., which is about half the capacity of the association's Davis Bridge reservoir in Whitingham, Vt. The net average head at this lower development will be 164 ft., which will develop 120,000 kw. in four generators of 30,000-kw. capacity each.

At the upper development there will be built a dam approximately 175 ft. high, having a width at the base of 1,000 ft. and at the crest of 25 ft. At this dam the length of the crest is some 3,300 ft. over all and the elevation 820 ft., roughly, above sea level. This dam will create a reservoir having a capacity of 73,500,000,000 gal., which is nearly twice the size of the Davis Bridge reservoir and will drain an area of 1,613 square miles. The reservoir will be twelve miles long and quite irregular in shape. The water at the power house will be conducted through penstocks 21 ft. in diameter, and there will be generated 105,000 kw. in four generating units. At this time no definite program has been formulated for the completion of this upper development, but the company holds it wise to say it will not be ready much prior to 1933.

National Association of Commissioners Meets Nov. 13

One of the important subjects set for discussion by the National Association of Railroad and Utilities Commissioners next week at New Orleans, where it will be in session from Nov. 13 to Nov. 16, is the Federal Trade Commission's investigation of public utilities. Lewis E. Gettle, head of the Wisconsin Railroad Commission, will, as chairman of a special committee, report on the investigation in all its aspects, and it will be the subject of a round-table discussion on Tuesday evening.

Speakers at the convention will include Clyde B. Aitchison, member of the Interstate Commerce Commission; Milton W. Harrison, president National Association of Owners of Railroad and Public Utility Securities; Theodore W. Artaud, director of research of the same association; W. A. Prendergast, chairman of the New York Public Service Commission; Henry M. Brundage, vice-president Consolidated Gas Company of New York; Ivan Bowen, a former member of the Minnesota commission, and H. La Rue Brown of the Automobile Chamber of Commerce.

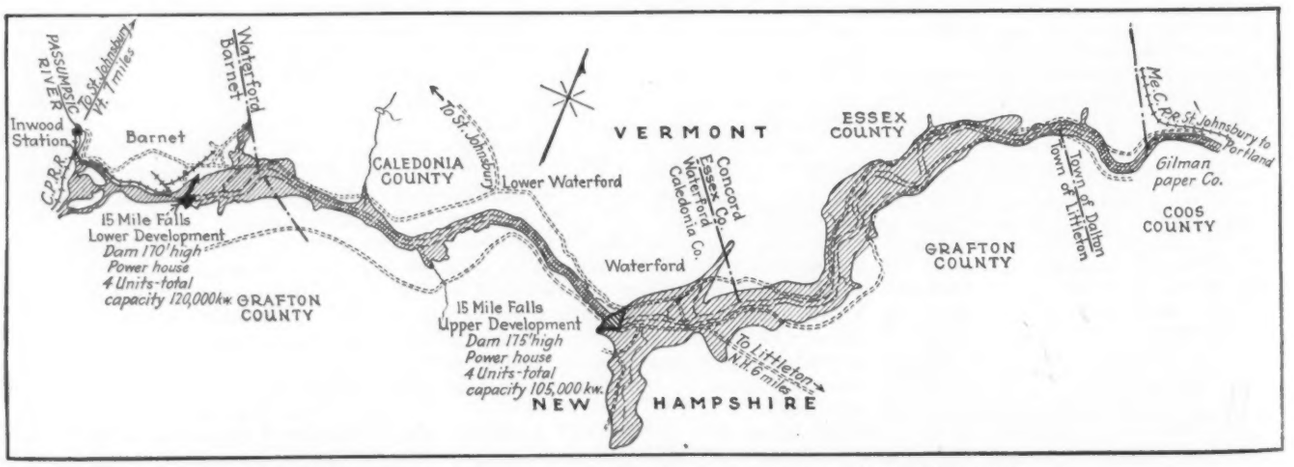
International Conference on Bituminous Coal

One Hundred Speakers, Representing Twelve Countries, Will Present Papers at Pittsburgh Next Month, Making up an Exceedingly Comprehensive Program

FOR the second international conference on bituminous coal, to be held, as already announced in the ELECTRICAL WORLD, under the auspices of the Carnegie Institute of Technology, Pittsburgh, on Nov. 19-24, a very comprehensive program, subject to change, has now been issued by President Thomas S. Baker. More than a hundred men, representing ten countries—France, Great Britain, Germany, Italy, Austria, Russia, Jugoslavia, Belgium, Denmark, Japan, Canada and the United States—are listed to present papers. Delegates representing governments or scientific organizations will also be present from Chile, Cuba, Czechoslovakia, Norway, Poland, Rumania and Spain. The ten major topics to be discussed are pulverized fuel, gas production, liquefaction and hydrogenation, fertilizers, origin, composition and classification of coal, high-temperature carbonization, combustion in furnaces, purification and cleaning, tars and oils, and low-temperature processes. A few of the papers of interest for electrical engineers follow:

Low-Temperature Distillation.—"Economics of Low-Temperature Coal Treatment," W. A. Darrah, president Continental Industrial Engineers, Chicago; "Low-Temperature Carbonization," Col. W. A. Bristow, managing director Low-Temperature Carbonization, Ltd., London; "Low-Temperature Carbonization of Coal by the Hayes Process," F. L. Tenney, consulting engineer, Milwaukee, and M. J. McQuade, president Ben Franklin Coal Company of West Virginia, Pittsburgh.

Origin, Composition and Classification.—"Classification of North American Coals," A. C. Fieldner, United States Bureau of Mines; "Recent Developments in Coal Re-



Site of New England Power Association's development at Fifteen-Mile Falls

search," Dr. Reinhardt Thiessen, United States Bureau of Mines, Pittsburgh.

Pulverized Fuel.—"Pulverized Fuel and Its Various Fields of Application," Dr. George E. K. Blythe, general manager Buell Combustion Company, London; "Thermodynamic Bases of Pulverized Coal Combustion," Dr. Ing. P. Rosin, Dresden, Germany; "Burning Bituminous Coals in Pulverized Form," Henry Kreisinger, research engineer, Combustion Engineering Corporation, New York; "Comparison of Stokers and Pulverized Coal," F. H. Daniels, president Riley Stoker Company, Worcester, Mass.

Power and Combustion.—"New Method for the Determination of Melting Processes in Ash," Prof. Karl Bunte, Technischen Hochschule Karlsruhe, Baden, Germany; "Removal of Ash and Loss of Carbon from Boiler Furnaces," Dr. David S. Jacobus, advisory engineer Babcock & Wilcox Company, New York, and E. G. Bailey, president Fuller Lehigh Company, Cleveland; "Clinkering of Coal Ash in Boiler Furnaces," Prof. Thomas G. Estep, Carnegie Institute of Technology; "Fusing Point of Ash on Mixtures of Coal and Foreign Materials," W. D. Langtry, president, and J. H. Kohout, chemical director Commercial Testing and Engineering Company, Chicago; "Some Potential Relations Between Electricity and Coal Utilization," A. T. Stuart, consulting engineer, Toronto; "The Kilowatt-Hour as a Manufacturing Product." A. R. Smith, construction engineering department, General Electric Company, Schenectady, N. Y.; "Boiler Furnaces for Bituminous Coal," Prof. A. G. Christie, Johns Hopkins University, Baltimore.

General.—"Recent Scientific Developments in Coal Research," Dr. Friedrich Bergius, Heidelberg, Germany; "Analysis of the Consumption of Coal in the United States," F. G. Tryon, Washington.

Engine Installation Designed to Operate at 1,400 Lb.

An unusual departure in power-station practice is brought to notice in an announcement of the Philip Carey Manufacturing Company. The installation will consist of two 5,000-hp. vertical triple-expansion engines directly connected to generators. These engines will operate at 1,400 lb. throttle pressure with steam at 800 deg. and will be installed for a closed system above atmospheric pressure with process-steam coils in the receivers between cylinders.

The steam generating equipment for the high-pressure plant will be furnished by the Combustion Engineering Corporation. The boilers will be rated at 1,800 lb., with integral economizers, water-cooled furnace walls, air preheaters, superheaters and pulverized-fuel equipment. The engines will be furnished by A. Borsig of Berlin, Germany.

This plant employs one of the highest pressures used by any plant in the world and embodies some new equipment and ideas for which W. E. S. Dyer, consulting engineer, is largely responsible. The high-pressure reciprocating engine, the closed circulating system above atmospheric pressure and the use of coils in receivers to produce process steam are unusually interesting features of the contemplated station. Preliminary work indicates very favorable costs and high thermal efficiency.

Briefer News

How Power Development Helps Textile Industry. — An interesting phase of the New England Power Association's coming Fifteen-Mile Falls hydro-electric development is that the textile business of New Hampshire is being stimulated in that thousands of pairs of blankets have been purchased for the comfort of the working force employed. This purchase of blankets is to be followed by wholesale buying of overalls, woolen hosiery and cotton. All supplies, as far as possible, are to be purchased in New Hampshire.

Richmond, Ind., Joins the Well-Lighted Cities.—Eighty-seven blocks of newly lighted boulevards in Richmond, Ind., will in a few weeks be added by the municipality to installations now existing, making a total boulevard lighting system of 163 blocks, with 839 new lamps. Fifty city blocks will receive ornamental lights next year, according to the present program. This will put Richmond's street lighting among the most modern in the Middle West.

Louvre Galleries Now Lighted by Electricity. — The art collections in the famous Louvre galleries in Paris, which have always been viewed in semi-darkness by thousands of winter visitors, will be plainly visible in the future as the result of the elaborate electric lighting system which has just been placed in operation. For years the proposal to light the Louvre by electricity has been opposed on the ground of fire risk, but since the successful use of electricity in the National Library, which houses the most valuable national manuscripts, the Louvre authorities also have desired to adopt modern lighting methods.

New Generator Placed in Service in Toronto (Ohio) Plant.—Turbo-generator No. 4 of the Toronto plant of the Ohio River Edison Company, operated by the Pennsylvania-Ohio Power & Light Company, has just been placed in operation. The new unit adds 37,500 kva. to its capacity, making the total 150,000 kva., or just one-half the planned ultimate development. The generating unit is complete in every detail, but the additional boiler installation will not be completed before the end of this year. This station has been designed and constructed by Stevens & Wood and has cost to date with all facilities about $16,000,000.

Transmission at 110 Kv. Planned for "Southern Tier" Cities in New York State.—Plans for construction of a 150-mile, 110-kv. transmission line connecting Rochester with "southern tier" cities in New York State, including all points on the recently developed E. L. Phillips circuit, are announced by G. R. Mills, president of the Lamoka Power Corporation and moving figure behind the project to utilize Lamoka hydraulic power twice at independent levels. The line would make both Niagara power and central New York power available to the districts served. Corning, Elmira, Hornell, Penn Yan, Canandaigua and Geneva are the largest towns on the proposed link.

Ninety-Mile Transmission Line from Colorado Springs.—A 90-mile, 44,000-volt, wooden-pole transmission line has been built by the Commonwealth Utilities Company of Denver running east from Colorado Springs, where power from the municipal plant is purchased, through El Paso County, to serve small towns. The project will cost in all approximately $250,000. The company is also planning to serve various communities on the Denver highway now needing light and power.

Philadelphia to Have Electric Show. — Philadelphia's first electric show in seventeen years will be held Nov. 17 to 24 in the Commercial Museum under the auspices of the Electric Club of Philadelphia. Space contracted for indicates that there will be more than 125 different exhibitors in all branches of the electrical and radio industries. The show will emphasize the development and application of electricity in the home, factory, store and office, both in the way of lighting and in the use of electrically driven devices.

Rate Reductions in Oregon.—An annual saving of $50,000 has been made possible to Oregon residential, commercial lighting and commercial cooking customers in the counties of Hood River, Wasco and Umatilla, according to a revised tariff just filed by the Pacific Power & Light Company. These reductions in rates were made voluntarily, the commission announces. Its records indicate that rate reductions for light and power service have been general throughout the state during the past three months.

Planning New Plant for Lincoln (Neb.) Capital.—The board of regents of the University of Nebraska and the State Capitol Commission have united in a request to Governor McMullen to recommend to the Legislature, which meets in January, an investment of $500,000 in a combination light, power and heating plant that will serve the new Capitol, now 75 per cent finished, and the various university buildings, from three-quarters of a mile to a mile distant. The university plant is inadequate and partly obsolete. Engineers' estimates show that a combination plant would save the state $150,000 in construction costs and greatly reduce rating expenses as compared with two separate plants. Such a plant would also be used for research and instruction work in the state engineering college. The Capitol is now served by a recently rebuilt state-owned plant at the state peni-

tentiary, which supplies energy also to other state institutions near the city. Neither the city light plant nor the Iowa-Nebraska Light & Power Company has indicated an intention to submit bids.

RATES TO BE LOWERED AT DES MOINES.—The Des Moines (Iowa) City Council has accepted proposals of the Des Moines Electric Light Company abolishing the flat rate of 6.6 cents a kilowatt-hour and substituting a sliding scale which it is estimated will net a reduction of $200,000 on lighting bills. The new rate is put at 6 cents for the first 30 kw.-hr., 5½ cents for the next 50 kw.-hr., and 5 cents for energy in excess of this. Minimum charge for home-cooking and power service is fixed at 75 cents in the Council resolution as against $1.50 proposed by the company, which has had a minimum of $3. The reduction will be dated from Oct. 15.

ALABAMA POWER COMPANY HELPS MOBILE'S GROWTH.—Since the completion of the Alabama State Docks at Mobile last June many new industries have been attracted to the old Gulf city, which is experiencing rapid growth. For attracting two of the largest of these to Mobile the Alabama Power Company claims direct credit. One is the plant of the International Paper Company of Alabama, located upon state-owned property north of the docks. It will be completed and placed in operation early in the coming year, at a total cost of approximately $5,000,000, and will give Mobile the largest industrial payroll it has had since the shipyard boom days of the World War period. The other is the wire-manufacturing plant of the General Cables Company, brought to Mobile by the Alabama Power Company's industrial development department. General Cables is a subsidiary of the Rome Wire Company of Rome, N. Y., and its Mobile plant will utilize copper from the company's mines in South America and hydro-electric power at the port. It will be an important addition to Mobile's tonnage production and payrolls.

WIND AND SALT OFFER PROBLEM ON GULF COAST.—Salt-laden breezes from the Gulf of Mexico have this year proved more than usually detrimental to the maintenance of transmission lines on the properties of the Central Power & Light Company, that organization reports. Such breezes are responsible for a salt deposit on transmission line insulators as far as 15 miles inland. Without the aid of washing rains this coating on the insulators becomes thicker and the inevitable result is that electric currrent leaks over the insulators, causing serious line losses and the burning of cross-arms and poles. When the leakage is excessively heavy the current flashes over and causes a momentary interruption to service. The situation this year has affected all transmission lines in the Gulf Coast district in the vicinity of Corpus Christi and Robstown. Even 66,000-volt insulators operating at 38,000 volts have flashed over, burned poles and caused interruptions. Line crews, patrolmen and distribution crews have worked twenty-four hours a day washing insulators, changing burned poles and cross-arms and grounding all pins and bolts. A fine black dust floating on the winds frequently causes the same trouble.

CENTRAL NEW YORK LAKE-SHORE PROPERTY OWNERS OPPOSE HYDRO PLANTS.—The Finger Lakes Association of New York State is taking a stand to preserve the shores of Seneca, Cayuga and the other lakes of central New York against possible encroachments from hydro-electric companies. The association will assist property owners threatened with loss through raising or lowering of lake levels. A committee was named to enter into formal contract with water-power interests to maintain certain definite lake levels—an action understood to be welcomed by the hydro company promoters. Opposition was made to the proposed use of Lake Keuka as a reservoir without proper guarantee that the level of the lake will not be altered to the detriment of property. G. R. Mills, president Lamoka Power Corporation, declares that such fears are groundless.

MORE RIVALRY IN ONTARIO BETWEEN AMERICAN COMPANY AND HYDRO COMMISSION.—Bruce County, in the Province of Ontario, is now the scene of a power battle between the Ontario Hydro-Electric Power Commission and the Saugeen Power & Light Company, owned by United States interests. The private company wishes to serve the municipalities of Bruce County, but supporters of the Hydro are staging a strenuous opposition. On Oct. 29 the Town Council of Southampton, the principal municipality, voted four to three against submitting to the electors a bylaw which would enable the Hydro to operate there, but a little later it reversed its decision and by a vote of five to one resolved to submit the by-law on Nov. 26. The contest will take place in a municipality approximately in the center of the disputed territory and will be watched with keen interest by the municipalities of Walkerton, where the Saugeen company has headquarters; Port Elgin and neighboring towns and villages whose power destinies are affected. This controversy has awakened interest throughout the province because the Hydro commission is believed to regard it as the greatest thrust yet delivered at Ontario's public ownership project by private corporations.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

National Electrical Wholesalers' Association—Chicago, Nov. 12-16. E. Donald Tolles, 165 Broadway, New York.

National Association of Railroad and Utilities Commissioners — New Orleans, Nov. 13-16. J. B. Walker, 270 Madison Ave., New York.

International Conference on Bituminous Coal—Carnegie Institute of Technology, Pittsburgh, Nov. 19-24. S. B. Ely, Carnegie Institute, Pittsburgh.

Public Utilities Association of Virginia—Hotel Roanoke, Roanoke, Va., Nov. 21-22. A. B. Tunis, 301 East Grace St., Richmond, Va.

Electrical Credit Association—Central Division, Palmer House, Chicago, Nov. 22-23; F. P. Vose, 1008 Marquette Bldg., Chicago. New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

American Society of Mechanical Engineers—Engineering Societies Bldg., New York, Dec. 3-7. C. W. Rice, 29 West 39th St., New York.

GEORGIA PROMOTERS OF RURAL SERVICE SHOW MODEL FARM.—The Georgia State College of Agriculture, in cooperation with the Georgia Power Company, has prepared an exhibit of a model electrified farm in miniature. The buildings appearing on the model are the residence, garage, milking barn, milk house, feeding barn for dairy herd, poultry house, mule barn, implement shed and hog house. The farm is furnished with electric lights, running water and miniature electric appliances and motors, some of which are electrified. The residence is of painted gauze so that when the house is lighted on the inside the application of electricity in each room is shown. The size of the exhibit is 20 ft. x 20 ft., and the buildings are erected to a scale of ¾ in. to one foot.

NEW RATES FOR PASADENA MUNICIPAL SERVICE.—A new schedule of rates for light and power service supplied by the Municipal Light and Power Department of the city of Pasadena, Calif., are being planned, according to Benjamin F. De Lanty, manager of the department, under which the income of the department will be cut approximately $30,000 a year on street lighting, while on commercial power the rates will be cut to the extent of $26,000 and on power sold to the Municipal Water Department to operate its pumps the income will be decreased $4,000. A new rate for heating and cooking, expected to bring about increased business for the department, is as follows: First 150 kw.-hr., 3 cents per kilowatt-hour; next 3,000 kw.-hr., 2 cents; next 8,000 kw.-hr., 1½ cents, and all over 11,500 kw.-hr., 1 cent. Commercial power rate changes as set forth begin at 4 cents for the first 100 kw.-hr. and are gradually stepped down to 1 cent. No change is made in the 5-cent domestic rate.

MORE BIG EQUIPMENT FOR NEW YORK EDISON.—This week was selected for the shipment on Sunday from the Schenectady plant of the General Electric Company to the Waterside generating stations of the New York Edison Company of rotors for two 40,000-kw. frequency changers to be installed there in a specially erected building. These are the same size as the frequency changer now operating in the East River generating station of the New York Edison and the three are said to be the

largest equipment of this kind ever made. They will be put into operation about Feb. 1, and will serve to unify more completely the generating systems of New York and Brooklyn and facilitate the interchange of power between the 25-cycle and 60-cycle systems. It required the exclusive use of three tracks to convey the rotors from Schenectady to South Albany, whence they were loaded on an immense floating derrick, which conveyed them to New York.

Commission Rulings

RATE REDUCTION NOT A CONDITION PRECEDENT TO APPROVAL OF MERGER.—Declination by the New York Public Service Commission to exact a promise to reduce electric rates from 7 cents to 5 cents a kilowatt-hour as a condition precedent to approval of the merger of the Brooklyn Edison Company with the Consolidated Gas Company—a condition demanded by the city of New York—was justified by the commission in the following language: "It is urged by the city that, as a precedent to or part of the approval of this petition, there should be a reduction in rates from 7 cents to 5 cents of the Brooklyn Edison Company, and in behalf of this demand the city cites certain figures, being principally comparisons of different items of the balance sheets of the Brooklyn Edison Comany as of December 31, 1927, and June 30, 1928. . . . It is rarely advisable to form an opinion of a utility's financial conditions or possibilities on the results of a period less than one year. In this particular case the city seeks to establish its demand for a reduction in rates on the basis of the results of a half year." "This is not a rate case," the commission said elsewhere in its decision, "and it cannot be transformed into one simply by the use of assertive language. The commission has no control over market quotations and is in no way responsible for them. The idea that the stocks of these companies have risen to very high figures because rates are excessive, as the brief alleges, is disproved by the fact that the Brooklyn Edison Company stock has been at its highest after two successive reductions in rates. Rates are not based upon the amount of the stock issued by a corporation, but, under the law, solely upon a reasonable return upon the value of the property of the company used or useful in the public service."

INDIANA COMMISSION CONDEMNS SPECULATION IN UTILITY PROPERTIES.—Expressing its belief that utility rates in Indiana generally are too high and consolidation of utility properties in many instances is "adverse to public interest," the Indiana Public Service Commission has issued a statement seeking to justify its stand against the merger of some utility properties in the last few months. The statement says: "The commission has no hesitancy in saying that if the public is to be protected against undue and unreasonable rates, greater scrutiny must be given in the future to purchase and sales and consolidations. The commission believes that the present tendency toward consolidation of purely local utilities into larger corporations in many instances is adverse to public interest. The commission believes that close local contact with the controlling authorities of utilities is more conducive to good service and reasonable rates. The commission believes that utility rates generally are too high. It is determined to remedy this situation. The commission insists on its lawful right to approve or disapprove matters that come before it for sanction in the light of all evidence which it has bearing on such matters. Speculation in utility properties within this state has been very pronounced in the last few years. It is very clear to the commission that the tendency to inflate purchase and sales prices of utilities is a result of undue speculative activity. Purchase and sale price is used as a basis of security issues and becomes a factor in establishing fair value, which in turn determines rates. The commission cannot hope successfully to control rate making or the issue of securities if the present speculative activity among utilities is not more effectively controlled. Oftentimes unreasonable prices are paid for utilities. So long as valuations, security issues and rates keep pace with advancing purchase and sale prices, this practice will continue. Such a process is clearly adverse to public interest. The control of such matters is delegated by law to this commission. This commission feels it to be its duty to curb undue speculation in utilities within this state."

Recent Court Decisions

IS HIGH VALUATION PREJUDICIAL TO THE PUBLIC INTEREST?—As noted in the "News of the Industry" last week (page 904), the Circuit Court of Baltimore City has ruled against the Maryland Public Service Commission in the suit brought against the latter by the Electric Public Utilities Company of Chicago, which the commission forbade to purchase four small Maryland utilities, on the assertion that the price to be paid was excessive. The court remanded the case to the commission, directing it on two grounds to reverse its ruling. The first ground was that "we have no paternalism in government which undertakes to substitute the Public Service Commission as the board of directors of private business enterprises even of a quasi-public character or of those charged with a public interest. Commissions are at best the Legislature's sentinels posted in the public interest to prevent manifest public detriment, but it was never intended that private property, and such freedom to contract as still exists, and those rights which go under the general caption of 'pursuit of happiness,' for the protection of which governments were ordained, should be subject to the administrative whims of legislative agencies ordained clearly for the protection of public interest against manifest public detriment." The second ground was that "this is not an application to issue bonds or local securities to the investing public based on a definite valuation of these properties at the fixed figure of $518,000, but is an application of a person (though a corporate person) who has bought the total stock certificates of these four companies for the sum of $468,000 (subject to $50,000 still carried as a lien on the properties) and which petitioner has contracted to deposit them, along with other collateral aggregating some $7,000,000. . . . What is the evidence in this record of the 'public detriment,' assuming for the sake of argument that there is an overvaluation and that the commission's engineer is correct and the purchaser's engineers are wrong?"

ELECTRIC COMPANY HAS SAME DUTIES TO TELEPHONE LINEMEN ON ITS POLES AS TO ITS OWN EMPLOYEES.—Reversing the instructed finding of a jury in the lower court for the defendant in Arnold vs. Ohio Gas & Electric Company, the Ohio Court of Appeals has held that in an action for injuries sustained by a telephone company's lineman who came into contact with the electric company's line, which was about four feet above the telephone company's on the same poles, the evidence was sufficient for the jury on the question of negligence in maintaining uninsulated wires in a place where it had reason to know that danger to telephone linemen was involved. The company had the same duty to the telephone employees as to its own; violation of a section of the General Code requiring electric transmission wires maintained in public streets to be insulated was negligence *per se*, and that the victim would be entitled to compensation under the workmen's compensation act did not deprive him of the right to recover from the electric company such portion of his damages as would not be forthcoming under the act. (162 N.E. 765.)*

ANTICIPATED SAVINGS FROM WATER-POWER GENERATION CANNOT BE INCLUDED IN VALUATION.—In a finding remanding the case of the Tennessee Eastern Electric Company vs. Railroad and Public Utilities Commission (see ELECTRICAL WORLD for May 26, page 1120) to the commission for further action in accordance with certain instructions included in the court order, the Tennessee Circuit Court made many observations, based on the report of a special commissioner and supporting in the main the action of the regulating body. Among the most important was the following on the valuation of water-power sites: "The theory of water-power value based on alleged savings depends entirely upon too many uncertain and unstable elements. . . . In fixing the value of water power the same rule should be adopted as in fixing the value of steam power, and that is 'what it costs to produce it.' The water in the stream or on the watershed flowing into the stream has no power value whatever. Likewise, the coal in the earth or in a freight car has no power value. Water has power value only when it is harnessed and put over the wheel or through a turbine as the case may be. . . . This cost should be written into the rate base and the utility allowed a reasonable return on such valuation, provided such cost does not already appear in the valuation of its physical properties. If there is a great saving in generating electricity by water power, or combined water and steam, over steam power alone, as claimed by petitioners, then the value will be reflected in vastly increased earnings of the company due to an increased volume of business. . . . If petitioners are entitled to have this intangible value of $2,000,000 written into the rate base, on account of alleged savings, then every public utility using the same scientific process in generating electricity is entitled to have the same element of value written into its rate base. It, therefore, follows necessarily that the consuming public will be compelled to pay as much or more for electricity as if the same was generated by steam power."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

G. S. Humphrey Chief Engineer of Potomac Edison

George S. Humphrey, formerly electrical engineer for the West Penn Power Company, has been appointed chief engineer of the Potomac Edison Company and subsidiary companies in charge of engineering and of the generation and transmission of power. Though Mr. Humphrey received his technical training in the East, having been graduated from the Massachusetts Institute of Technology in electrical engineering in 1910, his first connection was as an employee of the Telluride Power Company at Provo, Utah. Subsequently when that utility was consolidated with the Utah Power & Light Company in 1912 he removed to Salt Lake City. He served as distribution engineer for the Utah company until 1918, when he became electrical engineer for the West Penn Power Company with headquarters in Pittsburgh.

Mr. Humphrey has been active in association work, having been chairman of the electrical section of the Engineers Society of Western Pennsylvania, chairman of the Pittsburgh section of the American Institute of Electrical Engineers and chairman of the engineering section of the Pennsylvania Electric Association.

A. V. MANSON, who for a number of years has been city engineer in Stratford, Ont., Canada, has resigned that position to become general manager of the Stratford Public Utilities Commission. The commission handles the gas and water departments as well as the electric department.

J. F. STILL, for several years in charge of the Athens district of the Tennessee Electric Power Company, has been transferred to Lenoir City to succeed J. A. Gillespie, who has assumed new duties at Maryville. Mr. Still has been connected with the utility since 1922 as local manager at Sweetwater and Athens. The Lenoir City district includes Loudon, Concord and Farragut.

JOHN A. MANLEY, who has for the past three years been manager of sales development for Fairbanks, Morse & Company of Chicago, has been elected vice-president in charge of sales, according to a recent announcement of the board of directors. Mr. Manley, whose career has been one of rapid advancement in the business world, was formerly manager of accounts for the nationally known advertising agency of Henri, Hurst & McDonald, also of Chicago. In his connection with advertising work Mr. Manley made a detailed study of the problems of industrial business development and it was the result of this work that brought him into the Fairbanks-Morse organization. In 1911 he was graduated from Northwestern University and entered the sales department of the Republic Tire & Rubber Company. After four years with this organization he joined the advertising staff of one of the Chicago newspapers. Later he was connected with Hart, Schaffner & Marx, studying the problems of the retail merchant, and after two years in this connection he affiliated himself with Henri, Hurst & McDonald.

H. D. LAIDLEY has resigned his position with the National Lamp Works of the General Electric Company at Chicago, to join the organization of R. Cooper, Jr., Inc., Chicago, distributor of General Electric refrigerators. Mr. Laidley will relinquish his present duties Dec. 31. T. D. Scarff of the Midland-Federal division in Chicago has been appointed assistant general manager to succeed Mr. Laidley, effective immediately.

GANO DUNN, president of the J. G. White Engineering Corporation, has been elected an alumni trustee of Columbia University, New York, to serve for six years. Mr. Dunn has been a distinguished member of the engineering profession for a number of years. He has been president of the American Institute of Electrical Engineers, the New York Electrical Society and the John Fritz Medal Board of Award. A former chairman of the Engineering Foundation, he has held membership on several international boards and commissions and has been a delegate to scientific congresses in this country and abroad.

ALBERT KLINGE, superintendent of the utilization department of the Public Service Company of Colorado, Denver, has been transferred to the safety and claims division as assistant manager under F. A. Tewksbury. R. LEE DAVIS, assistant superintendent of the utilization department, has been advanced to the superintendency. Mr. Klinge became identified with the Denver properties in 1909, following a connection with the Montgomery Light, Water & Power Company of Montgomery, Ala. Mr. Davis started with the Colorado unit about twelve years ago.

ALBERT F. KOETT, 66 years old, vice-president and a founder of the Kelley-Koett Company, Covington, Ky., manufacturer of X-ray machines and other medical high-frequency electrical apparatus, has announced his retirement from active work. He will be succeeded by J. EDWARD GEISE, secretary-treasurer and general manager, who will also retain his treasurership. Other changes include the addition to the directorate of D. Collins Lee, attorney and bank official, and Ulie J. Howard, attorney of Kenton County, Kentucky. WILBUR WERNER, who is a directorship, will assume the secretaryship.

John W. Lieb Decorated by French Government

Dr. John W. Lieb, senior vice-president of the New York Edison Company, has been made an officer of the Legion of Honor by the French government in recognition of the services he has rendered in furthering professional and industrial co-operation between French and American engineers and in facilitating the interchange between them of knowledge and experience regarding the construction and operation of central-station systems for the generation and distribution of electrical energy for light, heat and power. Insignia of the decoration have been presented to Dr. Lieb by the principal heads of the French electrical industry. They were offered to him during an informal dinner at the Vanderbilt Hotel, New York, Nov. 2, given by G. Girousse, president of the Société Nord Lumière and head of a delegation of French central-station executives and engineers which has been visiting the prominent electrical installations of the United States.

A. PENN DENTON, president and chief engineer of the Denton Engineering & Construction Company, Kansas City, Mo., has discontinued his business to join the National Electrical Manufacturers' Association. Mr. Penn Denton has been a leading figure in the electrical manufacturing industry for a number of years, devoting special attention to the development of the National Electrical Code and to the affairs of the Association of Electragists. A graduate of Cornell University, he spent four years with the General Electric Company in Schenectady, N. Y., in both commercial and engineering work. It was in the fall of 1908 that he entered business in Kansas, and since that time he has engaged in a general engineering, electrical construction and machinery repair business. Mr. Penn Denton has served for twelve years on the executive committee of the Association of Electragists International and has represented the association for eight years as senior representative on the electrical committee and for the same length of time as chairman of Article Five, wiring methods committee of the National Fire Protection Association. In his new connection with the National Electrical Manufacturers' Association Mr. Penn Denton will direct the amored conductor and metallic flexible conduit section.

VINCENT G. SHINKLE, secretary-treasurer of the Washington Water Power Company, has announced his resignation, to take effect Dec. 1, following an association which has covered a period of 21 years, during the last ten years of which he served as secretary-treasurer. He will devote his time

to personal interests. Mr. Shinkle entered the employ of the Washington Water Power Company as storekeeper in 1907. Two years later he became purchasing agent, and on June 1, 1918, he was made secretary and treasurer of the company.

R. M. Wood, resident engineer on the work for the Western Public Service Company at Laramie, Wyo., has been transferred to the work for the Houghton County Electric Light Company at Houghton, Mich.

R. H. Clark, superintendent of the Montana-Dakota Power Company at Marmarth, N. D., now has supervision over the light plants at Hettinger, Bucyrus and Reeder in the capacity of district superintendent.

Curtis W. Lehner, who has for the past six years been associated with the range section of the Westinghouse Electric & Manufacturing Company, has recently been appointed general sales manager of the Southern Ohio Public Service Company, Zanesville, Ohio.

Clarence E. Piper, formerly assistant production manager at the General Electric Company's Erie Works, has been transferred to Pittsfield, Mass., where he is assistant to the production manager, Frank R. Whittlesey. Mr. Piper entered the employ of the company in June, 1903, in the cost department at the Schenectady works.

Edward J. Driscoll, formerly with the General Power & Light Company at Chicago, has been appointed manager of the electric properties of the Central States Power & Light Company in Oklahoma. This includes the property of the Interstate Power Company at Cushing, where Mr. Driscoll will maintain his headquarters. He has had wide experience in the utility business, having been for years in charge of various properties of the General Power & Light Company and other utility companies.

Doyle Jurney, for the last four years connected with the electric properties in Cushing, Okla., in the capacity of manager, has resigned to enter private business there. He is associated with R. M. Tuttle, manager for several years of the Cushing Gas Company and the Cushing Pipeline Company. These former utility men, under the firm name of Tuttle & Jurney, will engage in the real estate, insurance and building and loan business. Mr. Jurney's resignation was effective Nov. 1.

John W. Lewis, sales manager of the Montana-Dakota Power Company at Kenmare, N. D., has been transferred to the northern section of the Black Hills district and Frank S. Marion, sales manager of the Miles City, Mont., division, has been sent to Rapid City, S. D. Mr. Marion's place at Miles City has been taken by Robert Naylor, formerly sales manager at Wolf Point in the Williston, N. D., division, and he is in turn succeeded by M. E. Anderson of Williston. E. I. Bergen of Minot has been appointed to fill the vacancy at Kenmare.

E. A. Stewart Heads Minnesota Utility

Earl A. Stewart, associate professor of agricultural engineering at the University of Minnesota in Minneapolis, has resigned his position to become president of the Northwestern Public Utilities Company, a Minnesota utility with main offices in Minneapolis. The resignation of Professor Stewart became effective Nov. 1. Professor Stewart has been a leader of the university power project at Red Wing, Minn., for several years, studying various practical uses to which electricity may be put on farms. In 1926 he was one of the eight delegates from the United States to attend the world electrical power conference held at Basle, Switzerland, at which 38 countries were represented.

Professor William Boss, head of the agricultural engineering department, declared that a successor to Mr. Stewart has not yet been named. The company which Mr. Stewart heads operates electrical plants in several communities in the state.

E. A. Stewart

Lewis H. Heebner has been appointed manager of the Manchester, Conn., district of the Hartford Electric Light Company. He was formerly manager of the Manchester Electric Company, which was lately acquired by the Hartford organization, and was for some years electrical superintendent of the industrial plant of Cheney Brothers at Manchester.

John N. Carlisle, connected with many enterprises of the Carlisle interests in northern New York, has been named president of the New York Conservation Association. The election of the officers took place recently at Lake Placid. Mr. Carlisle delivered an address before the gathering on "Reforestation by a Public Utility."

John R. Fisher of Marshall, Mo., has been retained by the city of Independence to fill the vacancy which was recently created in the operating organization of the municipal light and power plant by the resignation of O. C. Utter, formerly chief engineer. Mr. Fisher has had many years experience in the operation of steam plants and held a similar position at Marshall, Mo. where he has operated the municipal light and water system for the past five years.

A. E. Laffsa, who has been a member of the Minneapolis office staff for the past fourteen months, has been appointed assistant to the president of the Public Utilities Consolidated Corporation, a Foshay company. Mr. Laffsa will in the future be in direct charge of rate matters, tax matters, budgets for divisions and subsidiaries of the Public Utilities Corporation. He will also handle special analytics and reports for this department.

Robert J. Torrens has affiliated himself with Toltz, King & Day of St. Paul in the capacity of electrical engineer. Mr. Torrens engaged in electrical engineering work for the United States Navy for several years and also was formerly identified with the New York Edison Company. He is a member of the American Institute of Electrical Engineers, the Association of Iron and Steel Electrical Engineers, the American Society of Mechanical Engineers, the Illuminating Engineering Society and other similar associations.

C. B. Auel, formerly manager of employees' service of the Westinghouse Electric & Manufacturing Company, is now manager of the employees' service and works standard department, according to an announcement made by J. M. Hipple, East Pittsburgh Works manager. This new division was consolidated with the employees' service department. Mr. Auel is well known in the industry for his activity in connection with accident prevention work and with the safety movement in general, being a past-president of the National Safety Council. L. H. Schumacher, formerly superintendent of the inspection and test department, was appointed manager of the standards division of the new department. The two inspection departments formerly operated in East Pittsburgh have been combined into one, the inspection and test department, with G. W. Goebel as superintendent.

Obituary

Richard Devens, engineer associated with the Link Belt Company of Chicago, died Nov. 3 at his home in New York in his sixty-third year. Mr. Devens was a native of Boston and a graduate of the Massachusetts Institute of Technology.

Charles E. Pattison, a partner of Pattison Brothers, consulting engineers of New York, died at his home in Montclair, N. J., Nov. 1, after a long illness. Mr. Pattison was born in New York in 1864 and was a member of the Association of Edison Pioneers.

Financial and Statistical News

Stocks Sweep Upward in Post-Election Buying

SWEEPING upward with the wave of buying enthusiasm which affected virtually all stock groups following the election returns, utility issues are in some cases at new high prices and in very many instances close to previous high levels. Strength was shown especially by such common stocks as North American, Columbia Gas & Electric, United Gas Improvement, Commonwealth Power, Commonwealth Edison, Electric Bond & Share Securities, Electric Investors, etc. All of these issues showed at least a two-point gain during the first trading session after the election. Several of the preferred stocks of the power and light companies also showed substantial gains.

Stocks of the electrical manufacturing companies were also prominent in the post-election rise. Gains were recorded in the common stocks of Fairbanks Morse, Maytag, General Electric, Westinghouse and several others. Since the buying movement affected practically the entire list of stocks the returns were apparently interpreted by the financial community as indicating a continuance of present conditions of prosperity.

Middle West Utilities to Vote on Stock Increase

Directors of the Middle West Utilities Company have called a special meeting of stockholders for Dec. 1 to act on proposed increase in the authorized $6 cumulative no-par preferred by 250,000 shares and in the common stock by 500,000 shares. This will make the authorized issue of the $6 preferred 500,000 shares and of the common 1,250,000 shares.

Three New Light and Power Issues Offered

During the first week of November three electric light and power companies offered new issues to the investing public. The Pacific Public Service Company made an offering of two-year 5½ per cent secured convertible gold notes, totaling $3,400,000, at 98¾ and accrued interest, to yield about 6.17 per cent. This company, just organized, owns more than 99 per cent of the common stock of the Coast Counties Gas & Electric Company and all of the common stock of the California Consumers Company except directors' qualifying shares. These notes are convertible at any time at the option of the holder into the class A common stock of the company on the basis of 50 shares of stock for each $1,000 par value of notes. The class "A" common no-par stock is entitled to an annual dividend of $1.30 per share.

First mortgage gold bonds of the Georgia Power & Light Company were offered to the amount of $2,700,000 at 93¾ and accrued interest, to yield over 5.35 per cent. These securities, dated June 1, 1928, mature June 1, 1978.

The Federal Public Service Corporation made an offering of first lien gold bonds to the amount of $2,000,000, the price being 99 and interest, yielding about 6.10 per cent. The sale of this issue of bonds will provide funds to be applied in the purchase of controlling interests in public utility companies, the payment of indebtedness incurred in recent purchases of such interests, for working capital and other corporate purposes.

German Electrical Industry Capitalized at $1,000,000,000

By Dr. Gerhard Dehne
Berlin, Germany

OFFICIAL statistics on German joint-stock companies have recently been published. Since nearly all important enterprises are carried on under this type of organization, the statistics are most informing. The results as they relate to the electrical industry will be given separately for the two branches, energy production and manufacturing.

On Jan. 1, 1927, there existed 203 stock companies with a combined subscribed capital of 1,351,000,000 reichsmarks ($324,000,000). New enterprises and increases in capital during 1927 added three companies with 163,400,000 reichsmarks ($39,000,000); twenty, with 45,400,000 reichsmarks ($10,800,000), disappeared.

The large companies, those capitalized at more than 5,000,000 reichsmarks ($1,200,000), account for 88.6 per cent of the entire capitalization. Six companies, each capitalized at more than 50,000,000 reichsmarks ($12,000,000), had 37.7 per cent. They were:

Company	Capital Stock, Reichsmarks
Rheinisch-Westfälisches Elektrizitätswerke (Essen)	155 000,000
A.-G. Sächsische Werke (Dresden)	100,000,000
Preussische Elektrizitäts-A.G. (Berlin)	80,000,000
Uberlandzentrale Pommern (Stettin)	74,000,000
Hamburgische Elektrizitätswerke	66,000,000
Elektrowerke (Berlin)	60,000,000

This sequence is arranged according to capitalization. The rank according to kilowatt-hours sold was given in the Electrical World, Vol. 91, No. 12, page 620. Aside from the companies here summarized, it must be remembered that many light and power enterprises are not in the form of companies but are operated by municipalities or other public bodies; others are in the form of a limited liability society ("G.m.b.H.").

In January, 1927, there were in existence 259 joint-stock companies with a combined capital stock of 684,000,000 reichsmarks ($163,000,000). New organizations and changes during 1927 added seventeen companies with 185,200,000 reichsmarks ($44,100,000). Twenty-nine companies with 71,300,000 reichsmarks ($17,000,000) disappeared.

In the manufacturing group the large enterprises capitalized at more than 5,000,000 reichsmarks ($1,200,000) had 83 per cent of the whole capital. The four capitalized at more than 50,000,000 reichsmarks ($12,000,000) and comprising 58.1 per cent of the whole capital were:

Company	Capital Stock, Reichsmarks
Allgemeine Elektrizitäts Gesellschaft (A.E.G.)	186,000,000
Siemens-Schuckert-Werke	120,000,000
Siemens & Halske	97,000,000
Felten & Guillaume	60,000,000

The situation for the fiscal year 1926-27 of those joint-stock companies the shares of which were admitted to the German exchanges or the share capital of which amounted to more than 1,000,000 reichsmarks may be summed up as in the accompanying table.

The assets of the entire industry are set forth in Table II.

The combined value of the electrical industries therefore amounts to 4,088,000,000 reichsmarks, or slightly under $1,000,000,000.

In the light and power industry the long-term debt (bonds and mortgages) amounted to 50 per cent of the borrowed capital. This was due to the rapid development of generating and distribution systems and the necessary credits secured for this purpose. In the electrical manufacturing industry the long-term debt amounted to only 25 per cent.

Of the 49 electrical manufacturing companies, 38, with a capital of 576,-

TABLE I—CAPITALIZATION OF GERMAN ELECTRICAL INDUSTRY AS A WHOLE

	Light and Power Industry	Electrical Manufacturing Industry
(1) Number of companies	118	49
	Millions of Reichsmarks	Millions of Reichsmarks
(2) Nominal capitalization	1,264	573
(3) Actual capital	1,131	553
(4) Reserves	112	85
(5) Own capital (3+4)	1,243	637
(6) Bonds and mortgages	671	158
(7) Other debentures	674	465
(8) Borrowed capital (6+7)	1,345	623
(9) Net profits	92	41

TABLE II—ASSETS OF ENTIRE GERMAN ELECTRICAL INDUSTRY

	Light and Power Industry		Electric Manufacturing Industry	
	Reichsmarks	Per Cent of Total	Reichsmarks	Per Cent of Total
Plant investment	1,952,000,000	70.6	305,000,000	23.0
Materials on hand	63,000,000	2.3	296,000,000	22.4
Shares and securities of other companies	198,000,000	7.2	272,000,000	20.5
Liquid resources	551,000,000	19.9	451,000,000	34.1
Total	2,764,000,000	100.0	1,324,000,000	100.0
Allowances for depreciation:				
Total	103,000,000	.....	21,000,000	.....
In per cent of the plant investment	.....	5.28	.....	6.89
Working capital:				
Own capital	.....	47.8	.....	50.5
Borrowed capital	.....	52.2	.....	49.5

600,000 reichsmarks, earned an average net profit for the year of 6.45 per cent; eleven, with 68,600,000 reichsmarks, suffered an average loss of 0.77 per cent.

The receipt of orders at the end of the second quarter of the current year was as good as at the end of 1927. Material was needed for extensions and for modernization of electric light and power installations, and orders were numerous from the textile, metal, paper, metal-working, chemical and shipbuilding industries and from transportation. Lack of funds caused a decrease in orders from the coal-mining and the iron and steel industries. The government railway and postal services restricted their orders. A reduction also occurred in purchases for agricultural use.

In general, however, the electrical industry, and in particular the appliance manufacturing establishments, were kept busy because of an accumulation of unfilled orders from the home and foreign markets.

NEW ENGLAND POWER ISSUE APPROVED. — The Massachusetts Department of Public Utilities has granted the New England Power Company the right to issue 30,000 shares of additional capital stock at $30 per share. The department cut the number of shares to 30,000, although the company had requested the right to issue a substantially larger number of shares. The company also had desired to issue the stock ot $25 per share, which the department held too low. The company has been authorized to change the par value of the stock from $100 to $25.

AMERICAN COMMONWEALTHS POWER SYSTEM TO BE SIMPLIFIED.—At the present time a plan is under way making for the simplification of the American Commonwealths Power system by liquidation of the American States Securities Corporation, owner of all voting stock of the American Commonwealths Power Corporation. A special committee of the directors of the American States Securities Corporation has been appointed to propose for the approval of stockholders a distribution of all assets, including American Commonwealths Power's class B common stock, and other miscellaneous securities. Total assets of American States Securities appeared on the books on Dec. 31, 1927, at $53,284,730. Plant and investment were rated at $44,126,434 and miscellaneous investments at $4,355,341. American Commonwealths reported common stock and surplus of $14,193,929 on March 31, 1928.

Italian Company Enters American Market

With the purpose of retiring all floating debt and for other corporate purposes the Ercole Marelli Electric Manufacturing Company (Ercole Marelli & C. Società Anonima) made an offering of 25-year first mortgage sinking fund 6½ per cent gold bonds, series A, to the amount of $2,500,000. This company manufactures various lines of electrical equipment.

These first mortgage gold bonds, priced at 97 and interest, will be secured by a direct first mortgage on all the mortgageable property of the company in Italy. Each $1,000 and $500 bond carried a detachable stock purchase warrant entitling the holder to purchase forty shares or twenty shares, respectively, of fully paid and non-assessable capital stock of the company of the par value of 100 lire each at from $8 to $10 per share beginning June 1, 1929, up to May 31, 1934.

New Holding Organization for Massachusetts Companies

Announcement has just been made that a new organization called the Massachusetts Light and Power Association has been formed as a voluntary association for Massachusetts by the New England Power Association. The new company is to serve as a holding organization for electric distribution companies in the state controlled by that company. Names of the distribution companies concerned have not yet been made public.

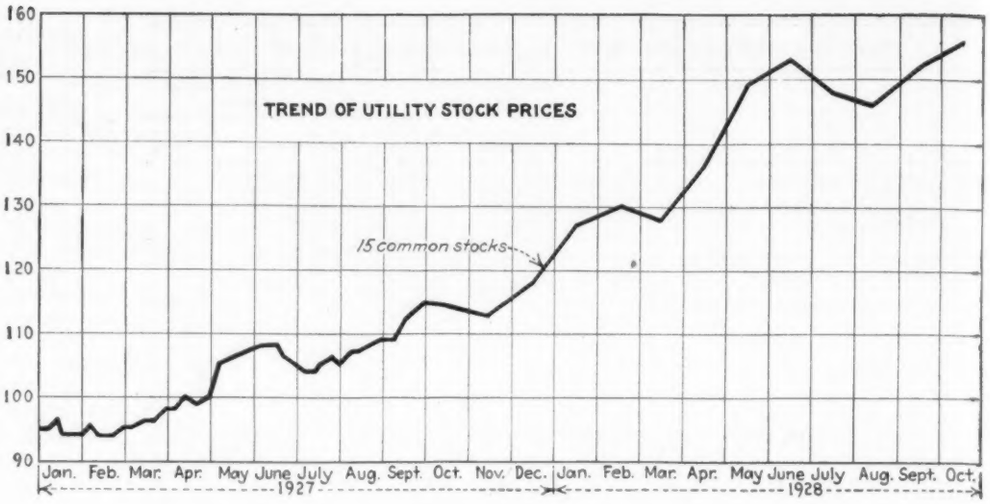
WAGNER ELECTRIC COMMON ON $6 DIVIDEND BASIS.—The directors of the Wagner Electric Corporation have declared a quarterly dividend of $1.50 per share on the common stock, no par value, payable Dec. 1 to holders of record Nov. 15.

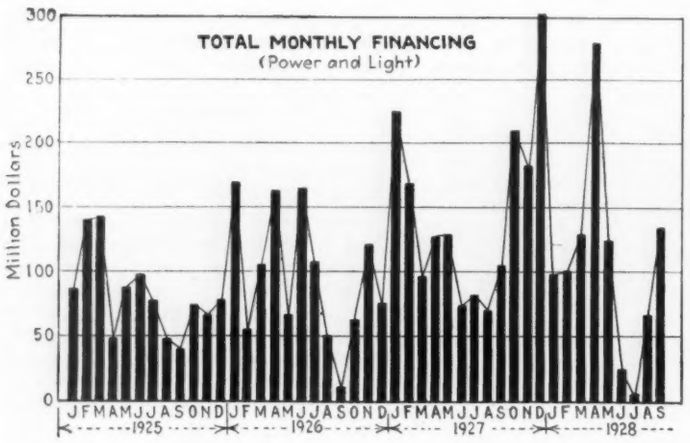
Current Earnings Reports of Electric Light and Power Companies

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American Light & Traction Subs. (Year ended Sept. 30)					
Gross earnings	$40,698,745	$36,574,360	11.3	67	68
Net earnings	13,468,623	11,480,284	17.3	..	..
Carolina Power & Light (Year ended Sept. 30)					
Gross earnings	8,955,139	8,778,897	2.0	50	53
Net earnings	4,449,200	4,096,394	9.0	..	..
Central & South West Utilities & Subs. (Year ended Sept. 30)					
Gross earnings	30,743,932	27,428,030	12.1	..	..
Net earnings	12,951,140	11,754,193	10.2	..	..
Blackstone Valley Gas & Electric & Subs. (Year ended Sept. 30)					
Gross earnings	5,994,215	5,891,095	1.8	62	64
Net earnings	2,256,696	2,118,571	6.5	..	..
Eastern Texas Electric & Subs. (Year ended Sept. 30)					
Gross earnings	7,660,025	6,929,618	10.5	61	63
Net earnings	2,983,225	2,539,554	17.5	..	..
Engineers Public Service & Subs. (Year ended Sept. 30)					
Gross earnings	30,840,548	28,986,533	6.4	59	62
Net earnings	12,580,415	11,142,017	12.9	..	..
Federal Light & Traction & Subs. (Year ended Sept. 30)					
Gross earnings	7,657,050	6,915,666	10.7	60	61
Net earnings	3,041,006	2,713,012	12.1	..	..

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
Galveston-Houston Electric & Subs. (Year ended Sept. 30)					
Gross earnings	$5,220,395	$4,978,237	4.9	67	69
Net earnings	1,685,445	1,507,543	11.8		
Kansas City Power & Light (Year ended Sept. 30)					
Gross earnings	13,522,148	12,012,104	12.5	51	49
Net earnings	6,591,916	6,094,444	8.2	..	..
North American Co. & Subs. (Year ended Sept. 30)					
Gross earnings	130,668,369	121,815,469	7.3	52	55
Net earnings	62,945,278	54,834,381	14.8	..	..
Puget Sound Power & Light & Subs. (Year ended Sept. 30)					
Gross earnings	15,088,078	14,557,735	3.6	57	58
Net earnings	6,515,578	6,189,825	5.2	..	..
Texas Power & Light (Year ended Sept. 30)					
Gross earnings	9,573,741	9,230,070	4.0	54	56
Net earnings	4,422,909	4,087,793	8.0	..	..
Utah Power & Light (Year ended Sept. 30)					
Gross earnings	10,892,318	10,634,655	2.0	49	48
Net earnings	5,574,174	5,560,024	0.2	..	..
Virginia Electric & Power & Subs. (Year ended Sept. 30)					
Gross earnings	15,995,059	15,316,566	4.4	58	59
Net earnings	6,779,569	6,161,686	1.0	..	..

Monthly Index of Business Trends *in the* ELECTRICAL INDUSTRY




TOTAL MONTHLY FINANCING
(Power and Light)
Million Dollars
300
250
200
150
100
50
0
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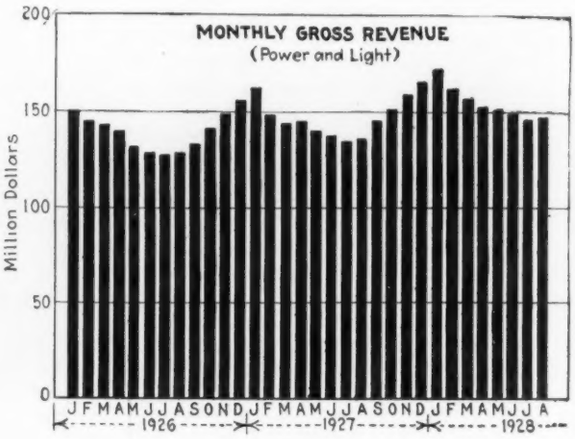
MONTHLY GROSS REVENUE
(Power and Light)
Million Dollars
200
150
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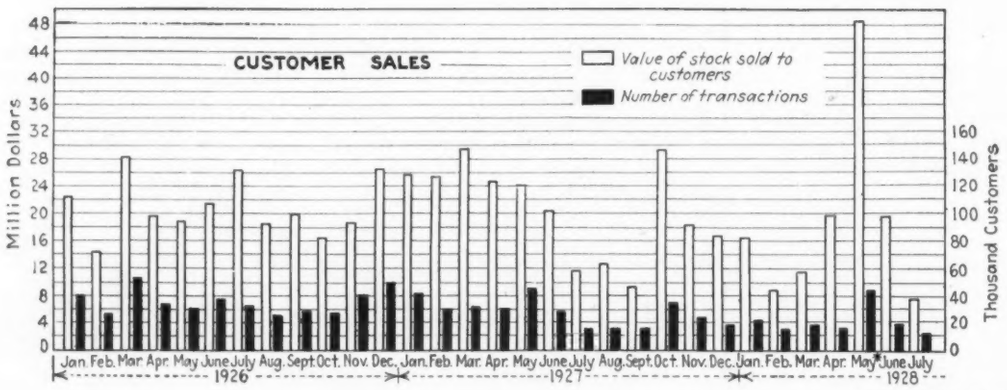
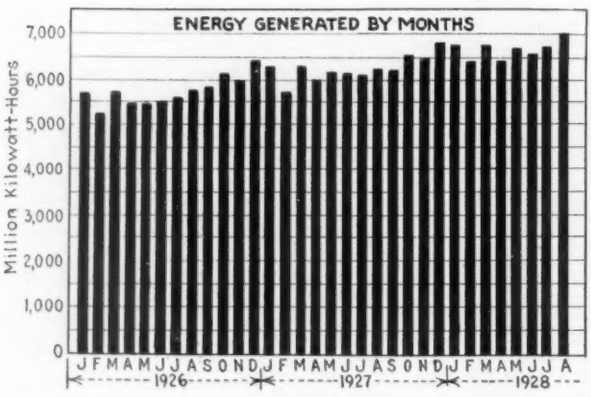
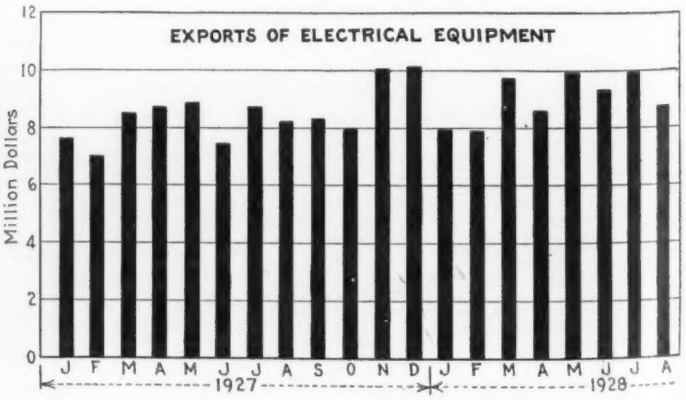


* *Represent chiefly exchanges for a seven per cent issue of an earlier date*





Business News and Market Conditions

Trade Analysis Indicates 1928 Record Year

Volume of Sales at New High in Many Lines and Above the Average in Great Majority

THAT 1928 will be a banner year for general business and industrial activity is indicated by the prospective large volume of fall and winter trade. Of the 38 most important lines of business and industry, thirteen report current conditions as excellent, nine as good, eleven as fair and only five as poor.

The 1928 sales of farm implements will almost certainly exceed those of 1927 by from 10 to 20 per cent. Export sales of farm implements continue to show large gains and many exceed 1928 by 30 per cent. September production of automobiles was 60 per cent larger than last year, and the year's totals will probably exceed last year's by 25 per cent. It is now almost certain that new construction for 1928 will be of record proportions. With comparatively few exceptions, profits of the larger industrial chemical companies will show substantial increases for 1928 as compared with 1927, and 1928 profits in the copper industry will probably show a gain of about 50 per cent as compared with 1927. Electrical manufacturing compain general are operating at higher rates than at this time last year, the September rate being of record proportions. The electric output and gross receipts of the public light and power companies continue their uninterrupted growth, with current operations more than 10 per cent above those of a year ago. Evidence accumulates in support of the belief that the closing six months of 1928 will constitute the best half year that the radio industry, broadly considered, has ever enjoyed. Notwithstanding the general decline in steel company earnings during the first half of the year owing to the lower average level of prices, increases should in most cases make a higher level for the year as a whole than in 1927.

That there are soft spots in the national economic structure, however, is evident from the reports of the five lines of business reporting conditions poor. With the coal industry it is doubtful if the leading companies will show better earnings than during 1927, and the majority of producers, both anthracite and bituminous, will actually report further declines. It is now a certainty that the full year's earnings of the railroad equipment manufacturers will be decidedly unsatisfactory.

Manufacturers Use Vastly Increased Power Equipment

MANUFACTURING establishments of the country today use approximately 50 times as much electric power equipment as they did at the beginning of the century, according to a study of primary installed power made by the National Industrial Conference Boards. Electric motors installed in factories in 1925 aggregated 26,123,573 hp., as against 492,936 hp. in 1899. But while the 492,936 hp. of electric motors in 1899 constituted only 4.9 per cent of the total of installed power, the 26,123,573 hp. aggregate of electric motors in 1925 represented 73 per cent of all installed power, and indications are that this growth has continued. Most thoroughly electrified is the machinery industry, where practically 100 per cent of the power is electrically applied.

A significant change in the use of electric power for manufacturing, however, is noticeable in the growing trend toward increasing use of purchased current; that is, current supplied by central electric power stations, instead of the original method of generating the current in the establishment where it was to be used. In 1899 public utilities furnished the current to drive electric motors aggregating 182,562 hp., out of a total motor equipment of 492,936 hp.; that is, 1.8 per cent of the total installed power equipment was run by purchased current and 3.1 per cent consisted of motors run by "home-made" current. In 1925 the proportion was almost reversed, the utilities supplying motors aggregating 15,868,828 hp. with current, or 44.3 per cent of the total primary power, while factory-generated current was used for motors aggregating 10,254,745 hp., or 28.7 per cent of the total installed primary power equipment aggregating 35,772,628 hp.

The relative extent to which the major divisions of the manufacturing industries depend upon the public utilities for their electric current is indicated by the percentage of horsepower of motors driven by purchased current bears to the total horsepower of electric motors installed, set forth above.

Industry	Per Cent
Miscellaneous industries	85.1
Food (and kindred products)	75.4
Metals and metal products	72.6
Railroad repair shops	69.1
Rubber products	68.7
Transportation equipment	68.5
Machinery	67.1
Stone, clay and glass products	67.0
Textiles and textile products	61.3
Chemicals and allied products	59.2
Leather and its manufactures	59.1
Paper and printing	53.5
Tobacco manufactures	52.7
Lumber and kindred products	51.1
Iron and steel	45.2
Musical instruments, phonographs, etc.	43.8

Year's Building to Date Up 16 per Cent

October figures for construction in all parts of the United States confirm previous predictions that 1928 will be a record building year. Total value of contracts from Jan. 1 to Oct. 31 are $3,035,459,000, against $2,618,600,000 for the corresponding period of 1927. Expansion is seen in virtually all sections of the country. Details by districts are shown in the table below.

Value of Contracts by Sections in the United States and Total for Canada, October, 1928

Thousands of dollars (-000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date, U. S.	Canada
Water-works	.....	$43,211	$139	$285	$1,319	$923	$45,877	**$85,705**	$65
Sewers	$297	3,654	964	1,094	1,007	244	7,261	**86,389**	231
Bridges	435	815	4,221	1,638	1,639	579	9,327	**102,437**	30
Excavations, drainage, etc.	63	133	110	902	49	274	1,531	**31,584**	334
Streets and roads	1,396	10,077	4,792	11,124	12,275	7,429	47,093	**557,625**	559
Industrial buildings	1,930	7,453	30,555	5,007	2,233	6,882	54,060	**286,895**	2,060
Commercial buildings	8,075	81,631	4,034	32,346	15,737	9,586	151,409	**1,585,663**	10,496
Federal government	98	2,107	308	624	2,013	1,194	6,344	**59,834**	.....
Unclassified	262	7,403	22	3,299	15,191	3,555	29,732	**239,327**	1,125
October, 1928	12,556	156,484	45,146	56,319	51,463	30,666	352,634	.....	14,900
September, 1928	10,955	134,554	24,792	51,501	41,250	22,159	285,211	.....	10,149
October, 1927	9,360	81,485	21,994	53,262	46,591	39,296	251,988	.....	29,795
Year to date, 1928	**189,022**	**1,168,878**	**248,490**	**704,502**	**447,938**	**276,629**	.....	**3,035,459**	**132,053**
Year to date, 1927	197,589	778,686	207,624	647,601	462,654	324,446	2,618,600	.....	118,332

Market Conditions

WELL-SUSTAINED demand for heavy industrial equipment in virtually all sections of the country speaks well for a continuation of the present satisfactory state of business. In New England and the Southeast substation equipment orders are moderately large and orders for small motors and other small equipment are normal. The Eastern district reports a large volume of this central-station equipment business as well as a satisfactory volume of the above-mentioned industrial equipment.

An upward trend in demand for railroad and steel industry equipment is noted in the Middle West, and power plant equipment is the feature of the St. Louis area. On the Pacific Coast there is a substantial volume of central-station equipment business, while industrial orders are in exceptionally good volume.

Metal Markets Quiet—Prices Firm

The scramble for copper exhibited by fabricators and other consumers of that metal late in October has quieted down. Business in all of the major non-ferrous metals during the last week has been in close-to-average volume. The price of copper is firm at 16 cents per pound delivered Connecticut Valley basis.

NEW YORK METAL MARKET PRICES

	Oct. 31, 1928 Cents per Pound	Nov. 7, 1928 Cents per Pound
Copper, electrolytic	16	16
Lead, Am. S. & R. price	6.50	6.50
Antimony	10¼	10.25
Nickel, ingot	35	35
Zinc, spot	6.60	6.60
Tin, Straits	49.425	49.75
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Nov. 7, 1928, 17¼ cents.

Lead is unchanged at 6.50 cents per pound New York. Prime Western zinc remains at 6.25 cents per pound East St. Louis, and Straits tin, at 49¾ cents per pound, is virtually unchanged from a week ago. Among the minor metals antimony is steady at 10¼ cents per pound for spot; cadmium is in excellent demand around 85 cents per pound, with some contracts calling for sales above as well as below that figure.

Industrial Business Active in Eastern District

Industrial account continues as the leader in electrical equipment business in the Eastern district. Not only are commitments increasing from different lines of industry, but the advancing number of inquiries gives particular encouragement in the situation. Cement mills, iron and steel plants and chemical factories have been active purchasers of primary equipment. A cement mill in Illinois has recently placed a large order with an Eastern maker for motors of different ratings for crushing machinery and other service, and further commitments are expected from this quarter in the early future. A chemical company in Michigan has ordered two 1,500-kw. motor-generator sets from a manufacturer in the East. A metal-working company in northern New York has given a commitment for electric welding apparatus to cost $10,000. A steel mill in Alabama has contracted with an Eastern manufacturer for a quantity of equipment to cost $135,000.

Prospective business both for industrial and central-station service is developing to a high point. A central-station company in New Jersey will build a power plant to cost $5,000,000. The Pennsylvania Railroad has announced intentions of electrifying its main line at a cost of $100,000,000, and an oil refinery in Texas will build a plant to cost $500,000.

Immediate central-station account is quiet, although impending developments point to an early revival of equipment purchases. A utility company in northern New York is in the market for a heavy duty steam-turbo unit with accessories and is expected to place commitment at an early date. Metropolitan central stations have been buying a fair amount of substation apparatus. A Pennsylvania manufacturer has secured a contract for a 5,000-kw. generating unit for a municipal power station in Iowa, to cost $85,000.

There has been a fair demand for motor-generator sets for office buildings in recent weeks, and new hotel structures, also, have been good prospects in this line. Electric refrigerating equipment continues under a satisfactory market and a good volume of business is being transacted. Wiring devices are quiet at the moment, with indication for an early pick-up to normal. Construction activities include the following:

The Oswego Industrial Company, Oswego, N. Y., plans a chemical plant to cost $200,000. The Montana Power Company, New York, will build a hydro-electric generating plant near Great Falls, Mont., to cost $4,000,000. The Nicholson Steamship Company, Detroit, contemplates a terminal warehouse and distributing building at Buffalo, N. Y., to cost $1,000,000. The F. J. Mullaney Iron Works, Inc., West New York, N. J., plans a plant at North Bergen, N. J., to cost $85,000. The Kent Garage Investing Corporation, New York, plans a multi-story automobile service, repair and garage building to cost $1,000,000. The Hammermill Paper Company, Erie, Pa., has plans for a mill at Hoquiam, Wash., to cost $1,500,000. The General Purchasing Officer, Panama Canal, Washington, will receive bids until Nov. 27 for a motor-generator set and control switchboard, copper rail conductor, etc. (Panama Schedule 1918). The Quartermaster Supply Officer, Washington, will receive bids until Nov. 20 for a large quantity of electric refrigerators (Circular 42). The Bureau of Yards and Docks, Navy Department, Washington, is asking bids (no closing date stated) for wire, cables, conduits, transformers, panelboards and other electrical equipment for the naval operating base at San Diego, Calif. (Specification 5659.)

Substation Supplies Active in New England

Sales of requirements for the completion of substations and additions to plants have been encouraging throughout the New England district. One prominent representative records orders for standard steel structures for circuit breakers, control apparatus and insulators amounting to more than for any previous month. Another records orders for active switch and meter buying. Sales amounting to over $3,500 for one southern New England station and several at approximately $1,000 for wire, hardware, poles and general equipment were reported.

Power equipment sales are steady and small motor sales are up, with sales reaching over $50,000. Machine tool manufacturers are active buyers and reports of large orders and brisk business in machine shops encourage the general outlook for sales of power equipment and control apparatus for some time to come. Heavy equipment is quieter, though several large projects are in view. Electric heating is active and appliance sales are steady. Construction projects are as follows:

The Landers, Frary & Clark Company, New Britain, Conn., plans an addition to its electric appliance manufacturing plant to cost $100,000. The Southern New England Electric Company, New Haven, Conn., will build an equipment storage and distributing plant.

Substation Equipment Ordered in Southeast

The largest order reported in the Southeast was for equipment going into a 140,000-kw. substation being constructed in the Carolinas, the order approximating $750,000, while the next order in size was for boiler and stoker equipment amounting to $200,000 going into a paper mill in Alabama. A power company in Georgia ordered poles and pole line materials totaling $10,000, while a smaller company in the same state ordered the same material to the extent of $3,000. Some other central-station orders reported were for an electric hoist costing $3,900 and distribution transformers amounting to $2,200.

An electric traction company in the Carolinas ordered a 40-ton locomotive costing about $30,000 and a cotton mill in Georgia ordered six large power transformers and 2,900 hp. in motor equipment costing $50,000. A textile mill in Tennessee bought inside wiring materials totaling $1,500 and inquiries have been made regarding a 1,000-kw. turbine for a cotton mill in South Carolina. Electrical construction materials amounting to $12,000 will be ordered this week for an office building job in Atlanta.

A country club in Tennessee ordered equipment for a "Monelmetal" electrical kitchen costing $5,000, while a hotel in a small town in Georgia ordered an electric bake oven and egg boiler costing $900. Wiring materials amounting to $2,000 were ordered for a rewiring job in one of the state institutions in Georgia. Construction projects are as follows:

The Virginia-Carolina Rubber Company, Richmond, Va., will make expansions and improvements to cost $200,000. The Wheeling Electric Company, Wheeling, W. Va., plans extensions and improvements in its lines, substations, etc. The Brown & Williamson Tobacco Company, Louisville, Ky., plans an addition to its factory, to cost $100,000. The Falls City Ice & Beverage Company, Louisville, Ky., plans extensions and improvements to cost $80,000. Beecher Smith, Somerset, Ky., has secured a franchise and plans an electric power plant and distributing system. Jupollo Public Service Company, Old Fort, N. C., will make extensions and improvements in the power plant of the White Coal Company, recently acquired. Greenville, Miss., plans a municipal light and power plant. Philadelphia, Miss., and Goldsboro, N. C., plan ornamental lighting systems. The General Refrigeration Company, Birmingham, Ala., will build a cold storage and refrigeration plant to cost $50,000.

Miscellaneous Orders Placed on Pacific Coast

The week on the Pacific Coast has been featured by some exceptional orders, such as the complete Westinghouse electrical equipment for a Diesel-engine-driven ferryboat for San Diego and 21 Pelton pumps valued at $80,000 for the Patterson irrigation district. Other large orders include a 2,000-kw. generator valued at $12,000 for a small hydro-electric plant, an assortment of 25- and 50-hp. industrial motors valued at $7,500 and orders for feeder motor automatic regulators totaling $20,000. Street-lighting business includes a $111,000 award to Nepage McKenny for relighting in downtown Oakland and 59 Duplex ornamental units for San Francisco. Vallejo is contemplating 24 additional standards and Porterville a $25,000 installation. Large prospective business includes a $3,500,000 San Pedro Hotel and resort, a $3,000,000 Sieberling tire plant for Oakland, $4,000,000 skyscrapers each for the San Francisco offices of the Texas and Shell Oil companies and a $1,000,000 bank and office building for Tucson, Ariz.

There has been considerable movement of small motors to scattered lumber mills and woodworking plants, following larger orders reported to have been placed for 30 indoor and outdoor regulators, costing $50,000, for the city of Seattle, a 400-hp. motor for the Bloedel Donovan lumber mill at Bellingham, about twenty-five miscellaneous small motors for the Pacific Coast Cement Company, Seattle; a 750-kw. turbine for the McCleary Lumber Company, Mason County, and eighteen motors from 75-hp. down for the Pierce County lumber mill. An agreement was signed by the Cowlitz County Commissioners and the Northwestern Electric Company at Kelso, Wash., for a hydro-electric project on the Lewis River, involving $5,000,000, providing for a large power house and dam near Woodland, Wash. The Vancouver Kraft Company, Ltd., Vancouver, B. C., plans the construction of a $2,000,000 pulp and paper plant at Port Mellon. A contract for lighting the Portland airport, involving about $18,000, was let. Pasco, Wash., will spend $15,000 in reconstructing the street lighting system. Construction projects are as follows:

The Santa Fe Railway Company, Los Angeles, plans an ice-manufacturing and precooling plant at Bakersfield, Calif., to cost $180,000. Los Angeles, San Gabriel, Vallejo, Madera, Merced, Oakland, Berkeley, Fresno and Richmond, Calif., plan ornamental lighting systems. The Board of County Supervisors, Los Angeles, will receive bids until Nov. 19 for a 400-kw. motor-generator for the Hall of Records. The Pacific-Goodyear Company, Los Angeles, will make extensions in its rubber tire manufacturing plant to cost $150,000. The Krumm Manufacturing Company, Mentone, Calif., plans an addition to its fertilizer plant to cost $100,000. The Edward Hines Western Pine Company, Burns, Ore., plans an addition to its mill to cost $90,000. The Northwestern Electric Company, Portland, Ore., has acquired a site near Kelso, Wash., and plans a power plant to cost $200,000. The Sitka Spruce Pulp & Paper Company, Marshfield, Ore., plans a mill to cost $500,000. Medford, Ore., plans a floodlighting plant at its airport to cost $120,000. The St. Helens Pulp & Paper Company, St. Helens, Ore., plans a mill unit to cost $150,000. Yakima, Wash., plans a lighting system on a number of streets. The Massey-Harris Company, Racine, Wis., contemplates an agricultural implement manufacturing plant at Great Falls, Mont., to cost $150,000. The Montana-Dakota Power Company, Miles City, Mont., plans a power plant at Baker, Mont., to cost $100,000. Denver, Colo., will install a floodlighting system at the proposed municipal airport to cost $100,000. The Ralston Purina Company, St. Louis, plans a factory at Denver, Colo., to cost $750,000. The General Motors Corporation, Detroit, will build an addition to its plant at Oshawa, Ont., to cost $100,000. The W. E. Phillips Company, Ltd., Oshawa, Ont., plans a power plant in connection with the glass-manufacturing plant at Regina, Sask., to cost $100,000.

Business Improving in St. Louis District

While there have been no orders placed for large size machinery in the St. Louis district general business in nearly all lines shows a slight improvement. In the last few days a marked increase has been noted in central-station buying. Several good-sized orders have been reported for distribution transformers, meters and heating appliances. Manufacturers of electric advertising signs have been doing a splendid business in the last month. Among a large number of small signs installed are noted five contracts for theaters, hotel, etc., the aggregate cost of which is $65,000. Jobbers are doing a good business in all lines of materials for building construction. Construction projects are as follows:

Trenton, Mo., will make extensions and improvements in its municipal power plant. The Little Rock Refining Company, Little Rock, Ark., plans an oil refinery to cost $150,000. Paris, Ark., will make extensions and improvements in its municipal power plant to cost $40,000. The Central Power & Light Company, San Antonio, Tex., will install an ornamental lighting system at Columbus, Tex., and will build a transmission line from Flatonia to Waelder, Tex.

Volume of Business Good in Middle West

The volume of business is gradually increasing in the Middle West. Reports of large industrials indicate a highly satisfactory condition. Increased business is reported by the steel industry and a number of the railroads are in the market for additional equipment. In the Chicago district a report of the construction of a million dollar addition to a rug mill has just been announced. Most of the utility companies have completed their larger construction programs and are now busy with maintenance and overload work. Several of the utility companies are in the market at this time for their requirements of cable for 1929. Jobbers' sales are generally good. There has been a good demand for vacuum cleaners and washing machines, one jobber placing an order for 2,500 vacuum cleaners and 500 washing machines. Construction projects are as follows:

The National Gauge & Equipment Company, LaCrosse, Wis., plans an addition to cost $100,000. The Tri-Service Mill Building Supply Company, Battle Creek, Mich., plans a factory to cost $80,000. The Rex Products & Manufacturing Company, Detroit, will build an addition to its chemical plant to cost $130,000. The Buda Manufacturing Company, Harvey, Ill., plans an addition to its railway equipment plant to cost $80,000. The Auburn Automobile Company, Auburn, Ind., plans an addition to its plant to cost $85,000. The Department of Conservation, Indianapolis, Ind., plans a power house at the State Fair Grounds. The Chrysler-Dodge Brothers Corporation, Detroit, plans an addition to its motor truck plant at Evansville, Ind., to cost $1,000,000. Hobart, Ind., plans a municipal electric light and power plant. The Goodyear-Zeppelin Corporation, Akron, Ohio, plans a Zeppelin aircraft manufacturing plant to cost $2,000,000. The United States Shoe Company, Cincinnati, Ohio, will build a factory at Louisville, Ky., to cost $175,000. Galion, Ohio, will soon take bids for extensions and equipment for a municipal electric light and power plant to cost $100,000. The Philip Carey Manufacturing Company, Lockland, Ohio, plans a power plant to cost $150,000. The Standard Electric Stove Company, Toledo, Ohio, plans an addition to its plant to cost $100,000. Wilberforce University, Wilberforce, Ohio, plans a power plant to cost $65,000. Rochester, Minn., plans an addition to its municipal light and power plant to cost $30,000. The Western States Utilities Company, Central City, Neb., plans a steam-operated electric power plant at Wausa, Neb. The Citizens Gas & Electric Company, Council Bluffs, Iowa, plans a power substation and extension to its 13,000-volt transmission line, to cost $60,000. Earlville, Iowa, and Lake Forest, Ill., plan ornamental lighting systems.

Activities of the Trade

Terms of Payment Policy Varies Widely

No Standard Practice with Regard to Credit Instrument or Interest on Overdue Accounts Adopted

CERTAIN illuminating data on terms of payment in the electrical manufacturing industry were presented by H. T. Bussmann, president of the Bussmann Manufacturing Company, at the recent convention of the National Electrical Manufacturers' Association held at Briarcliff Lodge, New York. The paper presented was compiled from 290 replies received out of 377 questionnaires sent out to the industry and the report was compiled by the policies division executives of N.E.M.A. Since 86 per cent of the questionnaires were answered, the report may be regarded as reasonably representative.

Analysis of the report shows that cash discounts are used in the great majority of cases. These discounts range from one-half of 1 per cent to 5 per cent and in an isolated case 10 per cent. The dominant discount appears to be 2 per cent. The discount period varies from ten to 30 days, with the former decidedly in the majority.

A large number, about 73, indicate that no discount is given. In only one case is a discount granted for cash. In regard to net cash payments, the most frequent term is 30 days, but the minimum period is ten days and the maximum 60 days.

Considerable variation of practice is evident with respect to the charging of interest on overdue accounts. In 216 cases, or about 75 per cent of the total, no interest charge is imposed. Among those who do charge interest, 6 per cent is unanimous with two exceptions, where the rate is 7 per cent. One indicated "current rate" and another that no definite rate was followed.

As to whether or not such interest charges are enforced immediately there is also a wide variation in practice. In some cases no definite rule is followed, but in the majority of cases a period of from 30 to 90 days is allowed, the mean being around 60.

No very fixed practice is evident with respect to the credit instrument involved. While notes or trade acceptances are used in a large number of cases, the answers are in many cases indefinite; e.g., "seldom," "occasional," "emergency," etc. In about 40 cases the trade acceptance is definitely stated to be used, and in only about twenty cases is it definitely stated that notes are used.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received a quarter-million dollar order from the Youngstown Sheet & Tube Company, Youngstown, Ohio, for electrical equipment for a 44-in. electrically driven reversing blooming mill. The new equipment will be installed in the Campbell works.

Railroad Electrification Order

The General Electric Company reports an order for equipment in connection with the electrification of the Boston, Revere Beach & Lynn Railroad, a narrow-gage road. Each motor car is equipped with two 60-hp., 600-volt, direct-current railway motors especially designed to meet narrow gage dimension requirements. The process required also two 1,000-kw. synchronous converters for changing the 13,800-volt alternating current to 600-volt direct current and other equipment of various classes.

Fairbanks, Morse & Company Show Increase in Bookings

Total orders booked by Fairbanks, Morse & Company for the quarter ended Sept. 30 were $8,191,055, against $7,844,810 for the corresponding period of 1927. Shipments for the quarter aggregated $8,342,507, against $7,951,306 for the third quarter of 1927. The volume of unfilled orders on the company's books at Sept. 30 was approximately 15 per cent greater than at the beginning of the year. The business of the current quarter has opened up well, according to the company's report, and the outlook is for good shipments during the remainder of the year.

THE HOLMES PRODUCTS, INC., 2 West 46th Street, New York City, manufacturer of electric refrigerators, has appointed J. M. Bickel as general sales manager of its company. Mr. Bickel was formerly assistant general sales manager of the Servel Corporation.

Graybar Electric Company Goes to Employees

TRANSFER of ownership of the Graybar Electric Company to its 2,500 officers and other employees is announced this week by Edgar S. Bloom, president of the Western Electric Company. The purchase will be consummated through cash and installment payment. The employees are organizing the Graybar Management Corporation to take over the old company. Graybar is one of the largest electrical supply organizations in the world.

Discussing the company's background, Mr. Bloom said:

The Graybar Electric Company was organized in 1925 to take over the Western Electric Company's merchandise business in electrical supplies. This was done in order that the Western Electric organization might devote itself primarily to serving the Bell system, as the continued expansion of the system, to keep pace with the demands of the American public for additional telephone service and facilities, placed a growing responsibility upon the Western Electric organization to meet the constantly increasing requirements for telephone apparatus and supplies.

Under the new arrangement there are three plans of purchase offered: An outright purchase of stock at $100 a share; subscriptions at the rate of $2 per month per share, requiring about four years to complete payments, and subscriptions at the rate of 20 per cent per annum, to be completed in five years.

The new company, it is announced, will remain exclusive agent for the sale of Western Electric equipment in this country, and it will continue to market other electrical products.

Graybar Electric Company is licensed by the Radio Corporation of America to manufacture and sell radio receiving sets, which the Western Electric Company cannot sell, except to the United States government and to the Bell system, by virtue of the patent pooling agreements at the time the Radio Corporation was formed. The company will thus be able to occupy an important position in the radio apparatus trade, and will market its own sets in its sixty-eight distributing centers throughout the United States.

Since its inception, the Graybar Electric Company has developed a nation-wide chain of wholesale warehouses for improving distribution of products marketed by it, taking in all of the larger cities and most of the important towns in every state. On Sept. 1 the company announced the inauguration of a new national system of dealer franchises involving the allocation of exclusive sales rights for Graybar radio receiving sets to approximately 3,000 dealers in the United States. Recently Graybar Electric announced a "new type" circuit to be used commercially in home radio receiving sets.

THE SPLITDORF ROL-IRON COMPANY, 2119 Lyman Place, Detroit, a division of the Splitdorf-Bethlehem Electrical Company, Newark, N. J., announces that E. P. Walsh has been appointed advertising manager of the company.

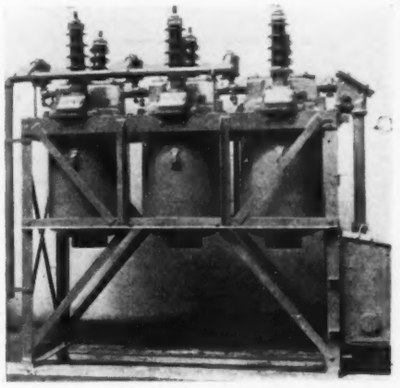
THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order amounting to approximately $200,000 from the Detroit Edison Company for several units of the new outdoor truck type switching equipment.

THE BIRMINGHAM GALVANIZING COMPANY, Birmingham, Ala., has appointed P. D. Woodbury to handle the sale of its galvanized pole line hardware. He formerly represented the Copperweld Steel Company in the Southeast.

New Equipment Available

Oil Circuit Breakers

A new type of oil circuit breaker electrically operated and built for heavy-duty service on alternating-current lines, applicable to both indoor and outdoor service, is announced by the Westinghouse Electric & Manufacturing Company. It is designed for 600, 1,200 and 2,000 amp. and 15,000 and 25,000 volts. The operating mechanism may be either the direct-current, solenoid or motor-



operated types, mechanically full automatic in all positions of the breaker's stroke.

At the point where the vertical pull rods from the mechanism connect with the horizontal pull rods, along the top of the breaker, a double bell crank housing is provided. This housing has a heavy partition separating it into two compartments; the pull rods from the operation mechanism enter one compartment and the pull rods to the pole units enter the other. Mechanical connection is made through the divided housing by a shaft-operated bell crank, which eliminates the possibility of transfer of oil and gas from one pole unit to another or from pole unit to mechanical housing. Each pole unit has a hydraulic bumper. A muffler eliminates oil throw and scavenging the gases. Bushing type transformers are optional.

Panelboards

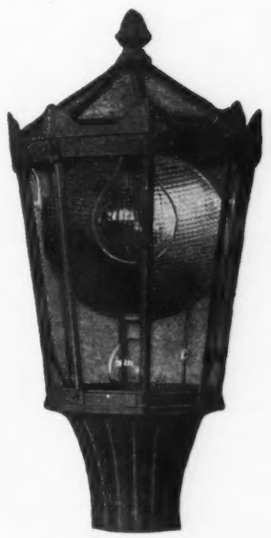
A new line of panelboards using Bakelite for all molded parts is announced by the Square D Company of Detroit. The main switches of 60, 100 and 200 amp. capacities are of brush type. The tumbler switches are 30-amp., 250-amp. ratings of the heavy-duty type and are easily removable from the front. The brush switches are of 250-volt rating, heavy-duty type; all metal parts are rustproof. The plug fuses and cartridge fuses are interchangeable. On door-in-door safety types no screws or removable parts are exposed when the door is opened at switch handles. All standard panelboards have 4-in. gutters on all four sides and fit in a code-gage, galvanized steel cabinet 19 in. wide.

Extension Sockets

An extension socket which extends the socket position 2½ in. by merely screwing the extension unit in the existing socket has been developed by the Westinghouse Electric & Manufacturing Company. The purpose of the new extension is to facilitate the use of certain new lamps with existing lighting units having a fixed socket position. The contact points and current-carrying parts are all nickel-plated brass, which insures satisfactory operation on 20-amp. circuits. A short-circuiting bar is provided so that when the lamp is removed from the socket the series circuit will be maintained.

Golden Glow Lantern Floodlight

The Golden Glow lantern floodlight, consisting of a complete floodlight unit mounted within an ornamental street lantern, has been announced by the Electric Service Supplies Company, Philadelphia. It is intended to provide modern floodlighting for locations where the installation of the ordinary type of floodlight unit would be unsightly and mar the architectural beauty of building and layout. It makes possible the floodlighting of a building where the space available for lighting equipment is limited to a 10-ft. sidewalk. By its use the lighting equipment is confined to

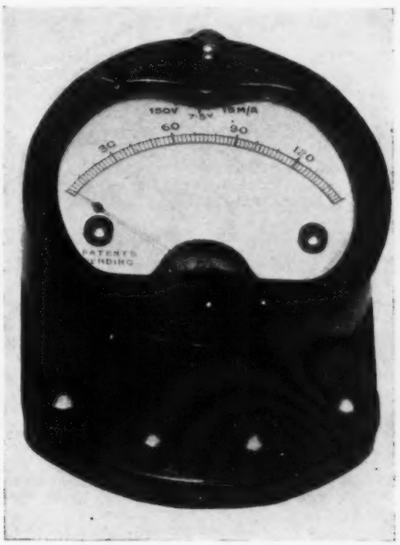


the property to be illuminated and may be controlled within the building.

The Golden Glow lantern floodlight is furnished in two sizes, having 9- and 14-in. diameter reflectors. In the former 300- or 500-watt lamps may be used, while the latter employes 750-, 1,000- or 1,500-watt lamps. The lamp socket is rigidly fastened to the reflector and the lamp bulb and reflector are adjustable for proper direction of beam of light.

Radio Meters

A new line of radio meters has just been announced by Ferranti & Company. There are three types, a portable of 1,000 ohms per volt, with three scale ranges of 10, 50, 250 volts, and a second, a three-range, 200-ohms-per-volt port-



able with voltage scales of 7.5, 150 and milliampere scale of 15 mills. The latter instrument is equipped with a switch for changing from one range to others and a fuse which protects the meter from being burned out in case the high voltage lead is connected to the milliampere scale by mistake. The third type consists of a flush pattern milliammeter which is available in ranges of 100 and 200 milliamperes. All of these meters are of the D'Arsonval moving coil type. The moving element has highly polished steel pivots running in sapphire bearings and girder type pointers of very light and strong construction with knife edge to facilitate accurate reading.

VAN DORN ELECTRIC VALVE REFACER—The new Van Dorn electric valve refacer has been designed to satisfy the demand for a machine that will reface valves with accuracy, combined with a capacity for a wide range of valve stems and valve angles, and which will at the same time have further uses, as sharpening cutters, grinding rocker arms, etc. It is adapted for general service station use, and has a capacity of ⅛ in. to ½ in. valve stem diameter, with a universal head which can be set at any angle. The wheel head is designed on a new principle in which a quill replaces the old sliding ways and is mounted in an adjustable housing, sealed from dust.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 23, 1928.)

Reissue 17,107. SADIRON; J. A. Spencer, Revere, Mass. App. filed March 5, 1926.

Reissue 17,108. METHOD OF MAKING CONTACT TIPS; W. W. Brown, Erie, Pa. App. filed Sept. 10, 1928.

1,688,330. APPARATUS FOR MEASURING THE SHRINKAGE OF MATERIALS; F. W. Gunther and G. P. Fisher, Ottawa, Ill. App. filed Aug. 15, 1925.

1,688,336. BATTERY SEPARATOR; W. L. Kann, Pittsburgh, Pa. App. filed Nov. 15, 1927.

1,688,353. MECHANISM FOR DRIVING AND CONTROLLING ELECTRICITY METERS; R. Pudelko, Zug, Switzerland. App. filed April 11, 1927.

1,688,360. PROCESS OF WELDING; G. N. Steigerwald, Philadelphia, Pa. App. filed March 23, 1923.

1,688,379. ELECTRICALLY-RELEASED BRAKE; J. W. Dodd, Brookline, Mass. App. filed June 3, 1925.

1,688,381. ELECTRICAL RESISTANCE; H. M. Dowsett, Colchester, and H. B. Tilley, Chelmsford, England. App. filed June 16, 1925.

1,688,399. STORAGE-BATTERY PLATE AND METHOD OF PERMANIZING THE SAME; W. L. Reinhardt, East Cleveland, Ohio. App. filed Oct. 11, 1922.

1,688,411. ELECTRICAL INSULATOR; W. S. Cook, Parkersburg, W. Va. App. filed Aug. 3, 1923.

1,688,478. ELECTRICAL CONDENSER; A. J. Weiss, West Orange, N. J. App. filed Jan. 13, 1927.

1,688,518. OUTLET-BOX-COVER ADJUSTER; J. G. Bennett, Arlington, Mass. App. filed May 21, 1927.

1,688,549. ELECTRIC LAMP; B. Llauradó, Santiago, Cuba. App. filed Sept. 25, 1926.

1,688,565. DRY BATTERY; W. M. Turnley, Toronto, Ontario, Can. App. filed Jan. 4, 1926.

1,688,567. BUS-BAR STRUCTURE; C. F. Wagner, Pittsburgh, Pa. App. filed Sept. 24, 1920.

1,688,584. CIRCUIT-BREAKER APPARATUS; O. S. Jennings, Mansfield, Ohio. App. filed Aug. 6, 1927.

1,688,631. SIGNAL SYSTEM; H. Hubbell, Bridgeport, Conn. App. filed March 30, 1925.

1,688,640. TERMINAL CONNECTING DEVICE; N. D. Levin, Columbus, Ohio. App. filed April 19, 1921.

1,688,680. APPARATUS FOR HEATING LIQUIDS BY ELECTRICAL ENERGY; G. Baum, Weissenstein-On-The-Drau, Karnten, Austria. App. filed Oct. 15, 1925.

1,688,693. INSULATED CABLE JOINT; E. D. Eby, Pittsfield, Mass. App. filed April 30, 1924.

1,688,694. PIEZO-ELECTRIC DEVICE; A. L. R. Ellis, Swampscott, Mass. App. filed July 14, 1925.

1,688,696. RAIL BOND; H. H. Febrey, Newark, N. J. App. filed March 16, 1927.

1,688,714. PIEZO-ELECTRIC-CRYSTAL APPARATUS; A. Hund, Bethesda, Md. App. filed May 12, 1927.

1,688,715. MOTOR-CONTROL MECHANISM; L. P. Hutt, Schenectady, N. Y. App. filed Dec. 19, 1924.

1,688,747. ELECTRIC SWITCH; W. E. Paul, Schenectady, N. Y. App. filed Oct. 10, 1925.

1,688,748. TRANSFORMER; W. E. Paul, Schenectady, N. Y. App. filed Feb. 9, 1928.

1,688,754. SWITCHING APPARATUS; W. M. Scott, Tredyffrin Township, Chester County, and J. H. Wyatt, Kirklyn, Pa. App. filed July 28, 1923.

1,688,777. GAS-FILLED ELECTRIC INCANDESCENT LAMP; J. Bergmans and T. J. J. A. Manders, Eindhoven, Netherlands. App. filed Nov. 4, 1927.

1,688,790. SYNCHRONISM-INDICATING MEANS; E. D. Cook, Scotia, N. Y. App. filed June 6, 1927.

1,688,796. OIL HEATER; W. E. Baker, Erie, Pa. App. filed July 31, 1924.

1,688,826. PERIODIC CIRCUIT CONTROLLER; C. P. Nachod, Louisville, Ky. App. filed Oct. 18, 1923.

1,688,833. PROTECTIVE CIRCUIT CONTROLLER; E. W. Seeger, Milwaukee, Wis. App. filed May 18, 1923.

1,688,848. SWITCHING APPARATUS; L. T. Barnes, Hempstead, N. Y. App. filed July 30, 1923.

1,688,853. OUTLET-BOX CONNECTION; M. M. Clayton, Baden, Pa. App. filed Aug. 14, 1926.

1,688,858. METER FOR MEASURING COMBINED POLYPHASE AND SINGLE-PHASE ELECTRICAL ENERGY; G. F. Drewry, Toronto, Ont., Can. App. filed Feb. 20, 1922.

1,688,866. FLUID-PRESSURE-OPERATED ELECTRIC SWITCH; C. C. Hansen, Forest Park, Ill. App. filed Nov. 5, 1923.

1,688,883. ELECTRIC CHAIN WELDER; J. Senft, York, Pa. App. filed June 18, 1924.

1,688,891. ELECTRIC MOTOR; C. C. Spreen, Detroit, Mich. App. filed Jan. 10, 1927.

1,688,916. MEANS FOR SYNCHRONIZING TWO OR MORE ROTATING BODIES; W. Bock, Berlin-Schoneberg, Germany. App. filed Dec. 9, 1927.

1,688,932. ELECTRICAL MEASURING APPARATUS; L. L. Lockrow, Edgewood Borough, Pa. App. filed Sept. 14, 1926.

1,688,951. IGNITION DEVICE; W. Walther and G. Rau, Stuttgart, Germany. App. filed Aug. 8, 1927.

1,688,954. ELECTRIC CABLE; R. W. Atkinson, Perth Amboy, N. J. App. filed Sept. 28, 1925.

1,688,960-1,688,961. ELECTRICAL CONDENSER; W. Dubilier, New Rochelle, N. Y. App. filed Nov. 30, 1925.

1,688,979. AUTOMATIC STATION INDICATOR FOR TRAINS; I. Mendelsohn, New York, N. Y. App. filed June 16, 1927.

1,689,004. APPARATUS FOR WAVING HAIR; C. S. Ackley, New York, N. Y. App. filed March 26, 1925.

1,689,006. VARIABLE-INDUCTANCE DEVICE; M. K. Akers, Troy, Ohio. App. filed Dec. 31, 1919.

1,689,007. THERMOSTATIC SWITCH PLUG; C. Arnesen, Chicago, Ill. App. filed March 24, 1926.

1,689,035. DOOR LOCK; B. Kovacs, New Brunswick, N. J. App. filed Feb. 24, 1927.

1,689,075. TRAFFIC-LIGHT CONTROL; O. R. Lehman, Springfield, Ohio. App. filed Jan. 28, 1927.

1,689,080. BINDING POST; A. H. Nero, New Britain, Conn. App. filed Jan. 14, 1921.

1,689,098. GROUNDING MECHANISM; C. W. Wyman, Claremont, N. H. App. filed March 24, 1924.

1,689,146. NEON TUBE; R. R. Machlett, New York, N. Y. App. filed Oct. 20, 1926.

1,689,187-1,689,188. DYNAMO-ELECTRIC MACHINE; R. Pohl, Berlin, Germany. App. filed Feb. 17, 1927.

(Issued Oct. 30, 1928)

1,689,196. POURING LADLE; J. S. Dunn, Philadelphia, Pa. App. filed Feb. 10, 1925.

1,689,198. IMMERSION HEATER; F. F. Gagelman, New York, N. Y. App. filed Nov. 22, 1926.

1,689,210. THERMOSTATICALLY OPERATED ELECTRIC SWITCH; R. W. McBrien, Alton, Ill. App. filed May 4, 1927.

1,689,227. SEAT SIGNAL SYSTEM; W. C. Burrell, Kankakee, Ill. App. filed May 13, 1925.

1,689,230. LOCKING DEVICE FOR SWITCH KEYS; H. J. Christopher, Westfield, N. J. App. filed Dec. 27, 1926.

1,689,232. ELECTRICAL FIXTURE WITH CONVENIENCE OUTLET; V. R. Despard, Valparaiso, Ind. App. filed June 18, 1924.

1,689,248. LOCK-NUT FOR ELECTRICAL CONDUITS; J. A. Malcolm, Cleveland, Ohio. App. filed Dec. 27, 1923.

1,689,292. NAVIGATION DIRECTING SYSTEM; H. W. O'Neill, Brooklyn, N. Y. App. filed June 25, 1923.

1,689,294. REMOTE CONTROL AND INDICATING SYSTEM; L. M. Potts, Tenafly, N. J. App. filed Nov. 27, 1925.

1,689,311. INSULATED WIRE; E. B. Wheeler, New York, N. Y. App. filed Oct. 9, 1924.

1,689,313. DIRECT HUMIDITY RECORDER; E. B. Wood, Chatham, N. J. App. filed March 18, 1926.

1,689,323. CABLE JOINT; N. E. Buck, D. W. Roper and A. P. Thoms, Chicago, Ill. App. filed Dec. 16, 1921.

1,689,369. ELECTRIC FURNACE FOR GLOWING METAL BANDS BY INDUCTION CURRENTS; M. Tama, Messingwerke, near Eberswalde, Germany. App. filed Nov. 29, 1927.

1,689,374. MACHINE FOR ELECTRICAL-RESISTANCE WELDING OF SHEET METAL PIPE; F. L. Williams, Denver, Colo. App. filed Sept. 25, 1926.

1,689,420. CABLE JOINT; N. E. Buck, D. W. Roper and A. P. Thoms, Chicago, Ill. App. filed March 26, 1923.

1,689,421. ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed July 3, 1922.

1,689,424. FUSE; N. J. Conrad, Wilmette, Ill. App. filed May 17, 1926.

New Trade Literature

MOTORS, SWITCHING EQUIPMENT, CONTROLLERS, ETC.—The General Electric Company, Schenectady, N. Y., is distributing the following bulletins: GEA-61B, describing its type CD constant-speed direct-current motors; GEA-153A, describing its automatic switching equipment for waterwheel-driven generators; GEA-518A, covering its type K-75 low, lightweight railway controller; GEA-249A, covering the GE-258 railway motor bearings; GEA-746B, describing its hinged-type finger for railway and industrial haulage controllers; GEA-807A, covering the repair of armatures for railway and industrial haulage motors; GEA-844A, describing its CR7009-B12 across-the-line type of magnetic reversing switch for single-phase, two-phase and three-phase motors; GEA-1019A, describing its instrument potential transformers for indoor service; GEA-1057, describing its type FK-12-B oil circuit breakers, and GEA-1059, covering its two-frame and four-frame motor drives for roving, spinning and twisting frames.

VALVE-OPERATING UNIT.—Publication DE-2 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, covers its type Ao motor-driven valve-operating unit.

POLE LINE HARDWARE AND DISTRIBUTION SPECIALTIES.—Hubbard & Company, Pittsburgh, have issued catalog No. 28 in which is listed and described the complete requirements in pole-line hardware and distribution specialties for every type of line construction. The material shown and the construction methods described represent the latest types used in each branch of line work.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Madras, India (No. 34,161), for hard and soft drawn copper wire.

Purchase is desired in Leipzig, Germany (No. 34,157), of electrical hot air driers and electrical household refrigerators.

Purchase is desired in Belleville, Canada (No.34,159), of household electrical appliances.

Purchase is desired in Santiago, Chile (No. 34,218), of phonograph motors.

Purchase is desired in London, England (No. 34,154), of electric household refrigerators and electric vacuum cleaners.

Purchase or agency is desired in Arad, Rumania (No. 34,156), for electric household refrigerators.

An agency is desired in Arras, France (No. 34,163), for electric refrigerator units.

Purchase and agency are desired in Arnhem, Netherlands (No. 34,213), for X-ray apparatus.

An agency is desired in Belfast, Ireland (No. 34,160), for wiring supplies and fixtures.